Washington State Department of Transportation

Memorandum

February 20, 2008

TO: Terry Berends

THRU: George Hilsinger/Rick Gifford

FROM: Moe Davari / Kristen Daniel
South Central Region
(509) 222-2402 / (509) 222-2431

SUBJECT: **US 395/Columbia Drive to SR 240 I/C Improvements**
MP 18.25 to MP 18.59
XL2527
Roundabout Geometric Design Approval

This Roundabout Geometric Design Approval has been evaluated and documented in accordance with Washington State Department of Transportation manuals and current design standards and procedures.

Moe Davari, P.E., Project Engineer

2/22/08
Date

MORTEZA DAVARI
STATE OF WASHINGTON
27081
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES 4/12/08

☒ Geometric Design Recommended for Approval ☐ Geometric Design Approval

George R. Hilsinger
Regional Traffic Engineer - South Central Region

2/25/08
Date

☒ Geometric Design Approval

Assistant State Design Engineer for South Central Region

5-6-08
Date

DOT Form 700-008 EF
Revised 5/99

Project Overview

This project proposes to provide the US 395 / SR 240 interchange improvements south of the Blue Bridge in Kennewick to improve traffic flow and reduce the risk of collisions. The improvements include adding a lane in each direction to US 395, constructing an off-ramp on the right side of southbound US 395 to SR 240, constructing an on-ramp on the left side of northbound US 395 from SR 240, constructing two roundabouts, one bridge, seven retaining walls, median, curb and gutter, landscaping, storm drainage systems, and illumination. No pedestrians or bicycles are allowed in the interchange area currently or in the future.

A mini VE-Study was held in April of 2006. The focus of the study was to switch US 395 southbound and SR 240 westbound and to maintain two lanes of traffic on southbound US 395. Several alternatives were proposed as part of this study. The preferred alternative replaced the partial cloverleaf interchange with a diamond interchange with roundabouts at the terminals on Columbia Drive. By removing the loop ramps, US 395 could maintain two lanes of travel south over the Columbia Drive bridge. It was deemed possible that if funding weren't available then the project could potentially be phased where the half diamond would be built on the west side of the interchange and the loop ramp left in place on the east side. Other alternatives included a diamond interchange with signals at the terminals, and a SPUI option.

The traffic analysis included not only the preferred alternative but also the signal option and the possible phased options. During the course of that analysis it was determined that the half diamond with the east side loop ramp in place failed in the design year because the sheer volume of traffic on the single northbound lane of US 395 was too great for the lane to handle. With the loop ramp removed, it became possible to provide two lanes of traffic northbound and brought the level of service up to acceptable levels. Due to the existing lane and shoulder widths of the Columbia Drive bridge in each direction, there isn't enough available taper length on or after the bridge to include two lanes and a right lane off ramp for NB US 395 to WB SR 240 traffic. Furthermore, where the loop ramp ties in to the westbound SR 240 there isn't sufficient taper length to accommodate a merge taper either. This creates a conflict point and is part of what caused it to be a High Accident Location (HAL). Removing the east side loop ramp removes a HAL from this interchange. These factors effectively eliminated the half diamond alternative with the existing east side loop ramp left in place.

Regional and HQ Traffic ran models of signals and roundabouts at the diamond interchange and found that the teardrop roundabouts performed better at this location than the signals. With signals, traffic queue lengths were such that traffic backed up onto mainline US 395. This reduced the desirability of the signals as an alternative.

The SPUI option was also eliminated because in order to build that they would be required to remove and replace the Columbia Drive Bridge. Removal of that bridge was not part of the original scope and would increase the cost of the project beyond the original budgeted amount.

Conceptual design approval was signed September 27, 2007 for the proposed teardrop roundabouts in the US395/SR240 Interchange project. This is a request for geometric approval of the proposed teardrop roundabouts.

For review and comment, attached is the roundabout geometric approval package that contains information/data/materials as given below:

- Channelization Plans (including Splitter Island Details)
- Design Decisions
- Geometric Data Spreadsheet
- Fastest, Natural, and Truck Turning Paths
- Sight Distance Display
- Signing and Illumination Plan

Currently, we are working towards Design Approval for the subject project. This project proposes to provide the US 395 / SR 240 interchange improvements south of the Blue Bridge in Kennewick to improve traffic flow and reduce the risk of collisions. The improvements include adding a lane in each direction to US 395, constructing an off-ramp on the right side of southbound US 395 to SR 240, constructing an on-ramp on the left side of northbound US 395 from SR 240, constructing two roundabouts, one bridge, six retaining walls, median, curb and gutter, landscaping, storm drainage systems, and illumination. No pedestrians or bicycles are allowed in the interchange area currently or in the future.

It was determined during design to leave a single lane on ramp from WB Columbia Drive to NB US 395 separate from the roundabout and remove any connection from the roundabout to NB US 395. Vertical alignment requirements from the roundabout to mainline US 395 caused the merge point of the NB on-ramp to be very close to the merge point for EB SR 240 traffic and NB US 395. The distance is substandard and in order to provide more distance between the two merge points, the Columbia Drive to US 395 on-ramp was left separate from the roundabout. There was also concern that congestion on mainline US 395 could result in traffic backups into the roundabout should the on-ramp be connected there causing the roundabout to fail.

There is a significant posted speed reduction from SR 240 to Columbia Drive. Traffic is moving at 60 MPH on SR 240 and must slow down to 35 MPH when entering Kennewick at Columbia Drive. As the interchange currently stands, traffic does not slow down as they enter into the busy commercial area. With the roundabouts in place, traffic will be forced to slow in order to safely navigate the roundabouts. This will slow traffic entering the city and increase safety near the interchange.

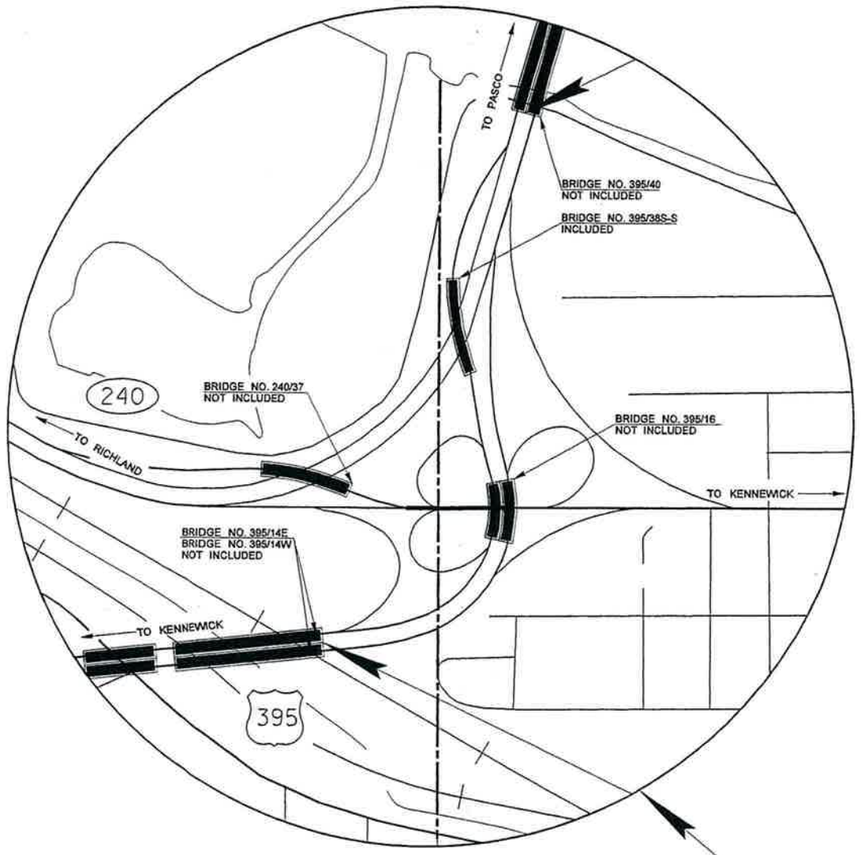
A project analysis is approved and several deviations have been identified:

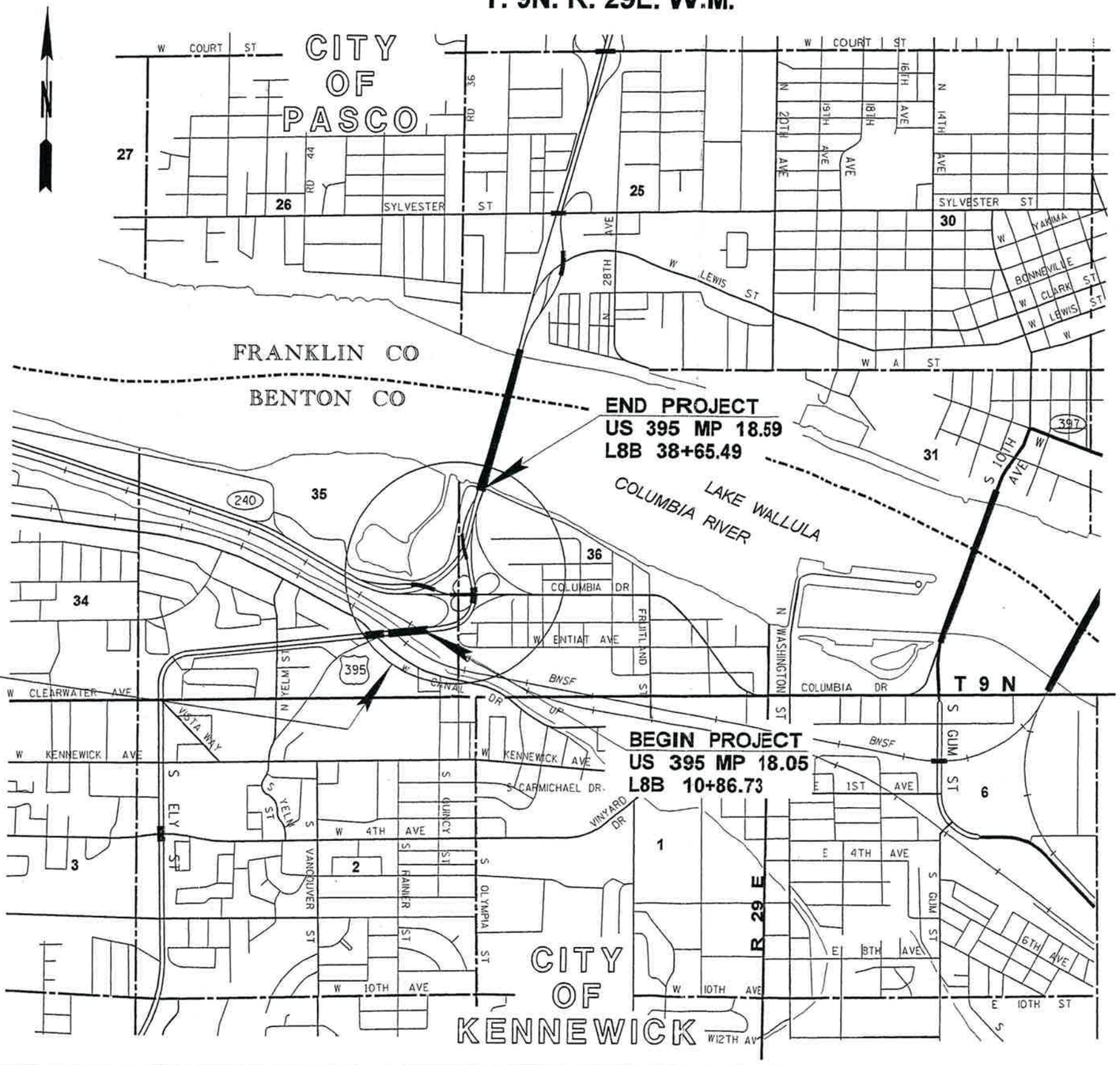
- Project Analysis – Proposed design level modified to a level between MDL-4 and P-1 design standards for US 395.
- Deviation #1 – Vertical Clearance under Bridge 395/16. We are lowering the grade of SR 240/Columbia Drive to give us 15.75' of vertical under the bridge but will still be unable to meet the minimum 16' required.
- Deviation #2 – An on-ramp on the left side of traffic – SR 240 will become and on ramp merging with US 395 on the left side of NB US 395. This is consistent with driver expectancy and will allow two lanes for NB US 395 traffic.

- Deviation #3 – Ramp Spacing between the SB off-off connection and the NB on-on connection on US 395 – Limited area prevents us from spacing the connections the minimum 1000' apart. The traffic analysis concluded that it will not cause any operational problems to have them closer together.
- Deviation #4 – Vertical Curve Lengths on US 395 SB – Curve lengths do not meet the minimum design speed of 50 mph but will meet the 45 mph posted speed requirements for comfort and 2' height.
- Deviation #5 – Deceleration length of off ramp from SB US 395 to Columbia Drive – Limited geometrics and the adjacent off ramp to SR 240 westbound prevents a full taper length.
- Deviation #6 (Combined with Deviation # 4) – Superelevation of new SB US 395 curve – limited geometrics required a tight radius curve in order to fit new alignment within the available area. The radius and superelevation curve will meet the posted design speed requirement but not the 50 mph design speed. According to the individual who performed the traffic analysis, it won't have an impact on the capacity of the new roadway.

If you have any questions or require any additional information, please contact me at (509) 222-2402 or Kristen Daniel at (509) 222-2431

MD/KD: jj
Attachments: Geometric Approval Package
cc: Project File





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DESIGNED BY	K. SABONG						
ENTERED BY	M. GANKSE						
CHECKED BY	K. DANIEL						
PROJ. ENGR.	M. DAVARI						
REGIONAL ADM.	D. WHITEHOUSE	REVISION	DATE	BY			

P.E. STAMP BOX DATE

P.E. STAMP BOX DATE

Washington State Department of Transportation

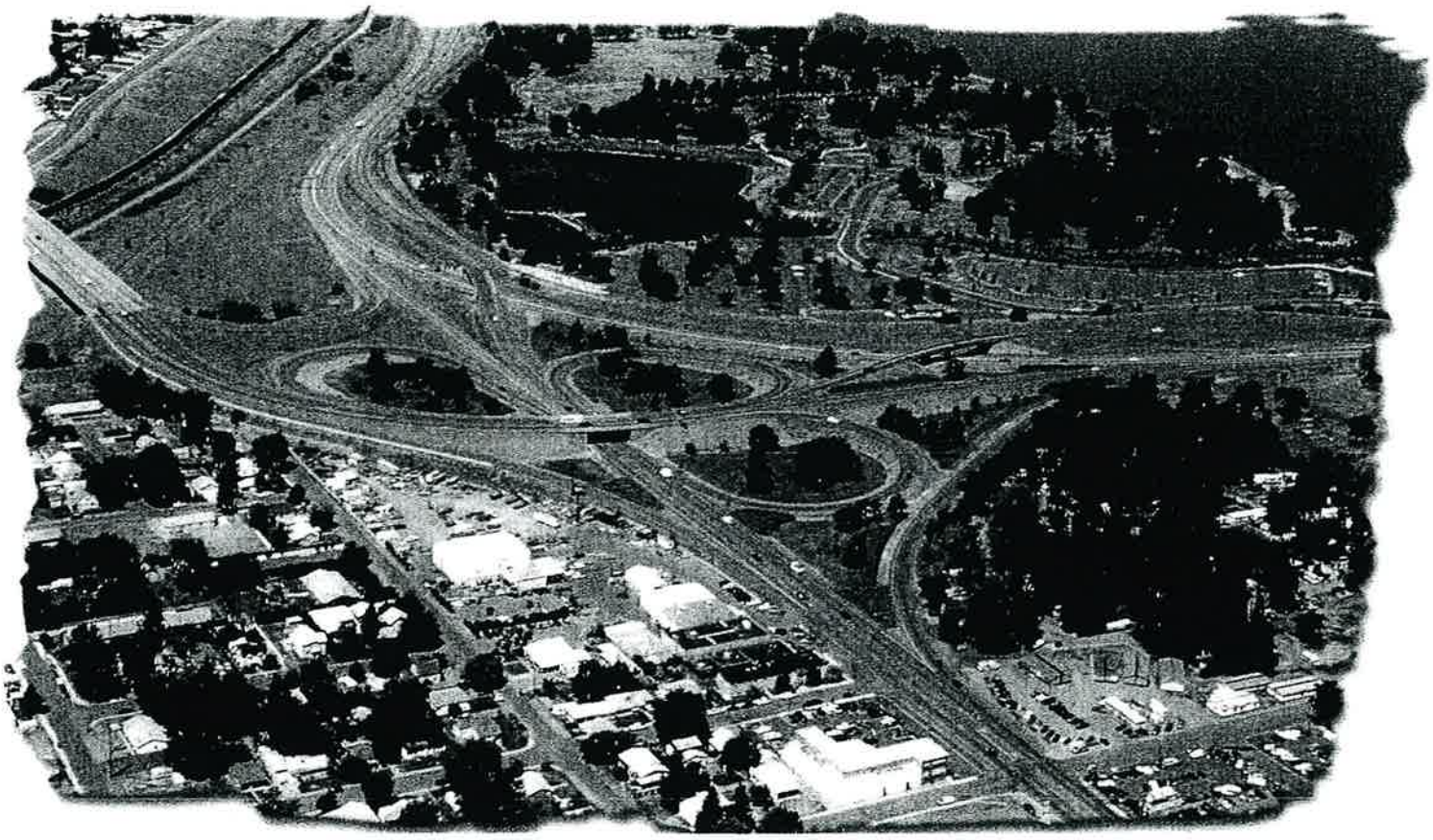
US 395
COLUMBIA DRIVE TO SR 240
REBUILD INTERCHANGE

VICINITY MAP

Plot 1
V1
SHEET OF SHEETS

US 395 & SR 240
Traffic Signal Analysis in support of the Roundabout Justification

June 2007



Prepared By:

Washington State
Department of Transportation

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US 395 & SR 240
Traffic Signal Analysis In support of the Roundabout Justification

June 2007

Scope of the Operational Analysis

It has been proposed to modify the US 395/SR 240 interchange that lies to the south of the "Blue Bridge" connecting the cities of Pasco and Kennewick, WA. The South Central Region has proposed modifications to improve the flow of traffic through the interchange. This will be accomplished by providing 2 lanes to US 395 in the north- and southbound movements. This would include the removal of all the loop ramps to be replaced by two roundabouts to service access to/from Columbia Drive. The purpose of this analysis is to analyze traffic signal alternatives in the design year and compare them to the proposed roundabout alternative.

Forecast Traffic Volumes

The forecast traffic volumes for this traffic signal analysis were developed in the *US 395 & SR 240 Interchange Justification Report Traffic Analysis*, June 2007, which contains the roundabout analysis. The traffic volumes were calculated by the Traffic Data Office (TDO) for 2009 and 2029. The traffic volumes for the various traffic signal alternatives are identical to those given for the roundabout analysis.

For the purposes of this operational analysis, only the PM peak in the year 2029 was analyzed. While some movements are counterflow in the AM peak, the critical volumes were larger in the PM peak. Volumes are similar enough in nature to make only a PM peak analysis necessary for the purposes of this study

Traffic Signal Analysis

Trafficware Synchro was chosen to evaluate signal operation for the alternatives analysis. In most cases, Synchro will give results different than the *2000 Highway Capacity Manual* and the Highway Capacity Software. Some of these deviations are necessary to accommodate modeling of coordination and actuation. When an intersection is coordinated, Synchro explicitly calculates the progression factor, while with the Highway Capacity Software (HCS+), it is necessary to guess about the effects of coordination. Synchro calculates the effects of coordination automatically and more accurately.

For the purposes of consistency, all signalized intersections were evaluated using Synchro. The Synchro values for control delay were spot checked against University of Florida McTrans Center's Highway Capacity Software (HCS+), and found to be close enough for the purposes of this evaluation. The slight differences in calculated values can be attributed to different green times, the allowance for dual ring controllers in Synchro, and calculation rounding differences.

Trafficware SimTraffic was chosen to evaluate 95th percentile queue lengths for the alternative analysis. SimTraffic provides a more accurate queue length than Trafficware Synchro because the model takes into account peak hour factor (PHF) adjustments, spillback beyond turning bays, and other subtle traffic flow interactions.

Assumptions

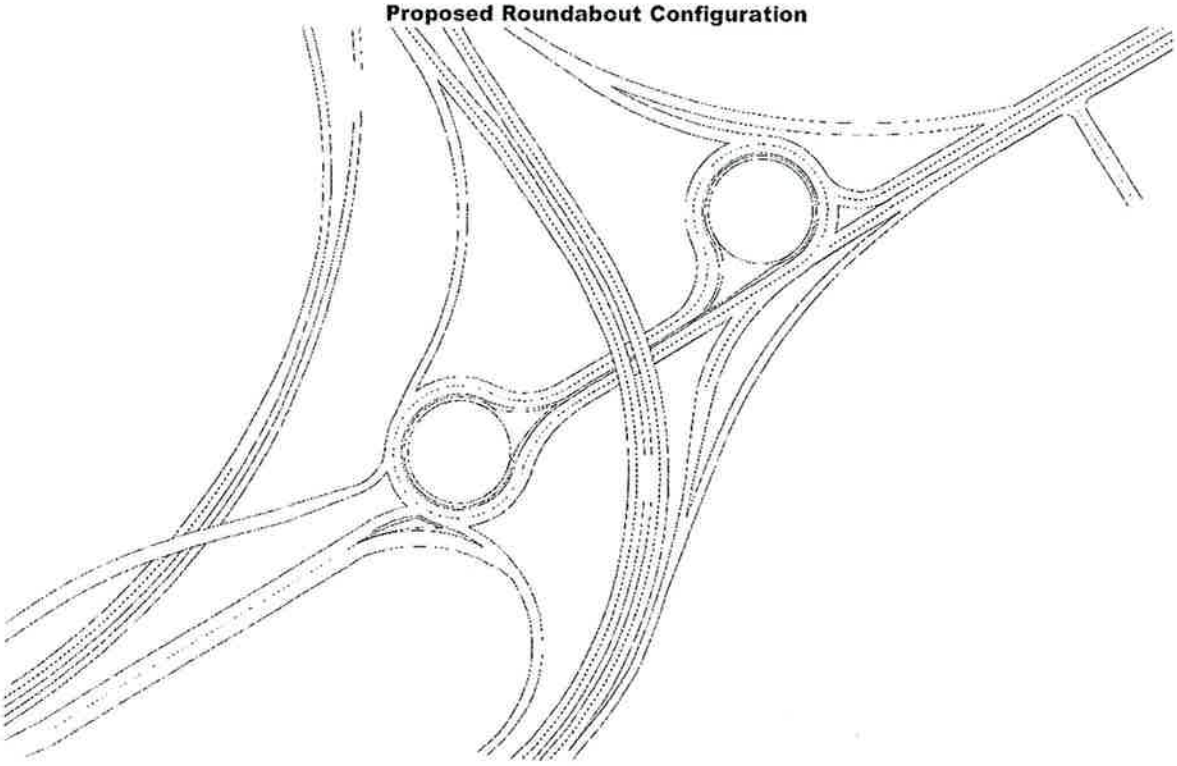
There following are the assumptions that were made to complete this analysis:

1. Trafficware Synchro was used instead of University of Florida McTrans Center's Highway Capacity Software (HCS+) to perform the traffic signal analysis. The assumption is that the Synchro output better accommodates modeling of coordination and actuation.
2. The existing US 395 overcrossing currently provides 4 lanes of travel for the Columbia Drive/SR 240 connection. Widening this structure or raising the structure would be cost prohibitive. Any alternative that requires more than 4 lanes under the structure will be rejected.
3. Peak Hour Factor (PHF) was assumed to be 0.90 in 2009 and 0.95 in 2029.

Proposed Roundabout Configuration

The South Central Region has proposed modifications the US 395/SR 240 interchange that would provide 2 lanes to US 395 in the north- and southbound movements. This would include the removal of all the loop ramps to be replaced by two roundabouts to service access to/from Columbia Drive.

Proposed Roundabout Configuration



The proposed roundabout configuration given in the *US 395 & SR 240 Interchange Justification Report Traffic Analysis*, June 2007 level of service and control delay for 2029 is shown in Table 1.

Table 1. Level of Service Analysis-Proposed Alternative: Diamond Interchange Two Roundabouts

Year	US 395 & NB Ramp		US 395 & SB Ramp	
	Weekday PM Peak		Weekday PM Peak	
	Control Delay (sec)	Level of Service	Control Delay (sec)	Level of Service
2029	7.6	A	13.2	B

Traffic Signal Alternatives Analysis

An operational analysis was performed of four traffic signal alternatives for 2029 to determine if traffic operation would fail. The analysis of the four alternatives is attached.

Alternative #1: Diamond Interchange with Dual Left Turns

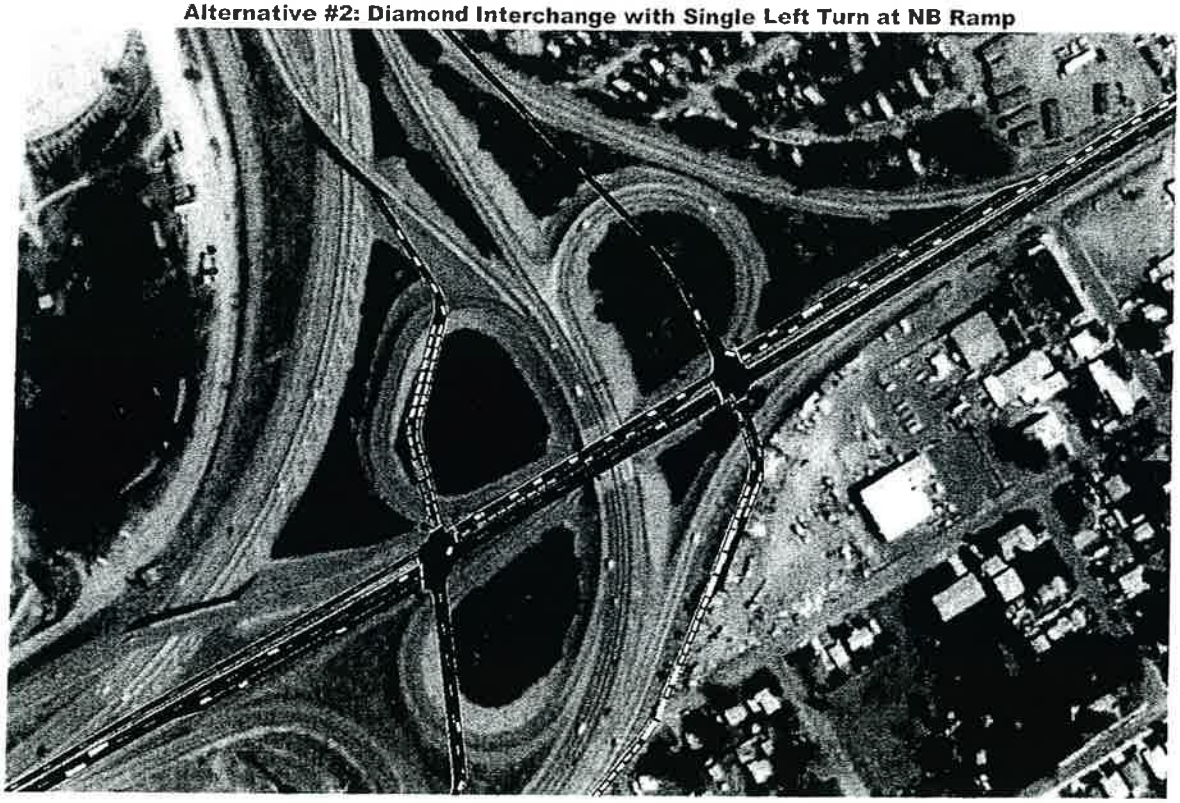
Alternative #1 involves the construction of an urban diamond interchange with dual left turns on both NB and SB ramps. This would necessitate 2 receiving lanes in the EB and WB direction. A WB left turn pocket would provide for a protected left turn phase. EB and WB free right turns would be constructed. The signals were evaluated and the Synchro level of service analysis is given in Table 2.

Table 2. Level of Service Analysis-Alternative #1: Diamond Interchange Dual Left

Year	US 395 & NB Ramp		US 395 & SB Ramp	
	Weekday PM Peak		Weekday PM Peak	
	Control Delay (sec)	Level of Service	Control Delay (sec)	Level of Service
2029	15.0	B	10.9	B

A SimTraffic queuing analysis indicates the WB left turn at the SB ramp would have a 95th percentile queue of 488 feet. It is not feasible to construct an adequate left turn pocket and maintain 4 lanes at the US 395 overcrossing. This alternative was rejected.

Alternative #2: Diamond Interchange with Single Left Turn at NB Ramp



Alternative #2 involves the construction of an urban diamond interchange with dual left turns at the SB ramp and a single left turn at the NB ramp. This would require 2 receiving lanes in the EB direction and one receiving lane in the WB direction. A WB left turn pocket would provide for a protected left turn phase and could be constructed as a trap lane. EB and WB free right turns would constructed. The signals were evaluated and the Synchro level of service analysis is given in Table 3.

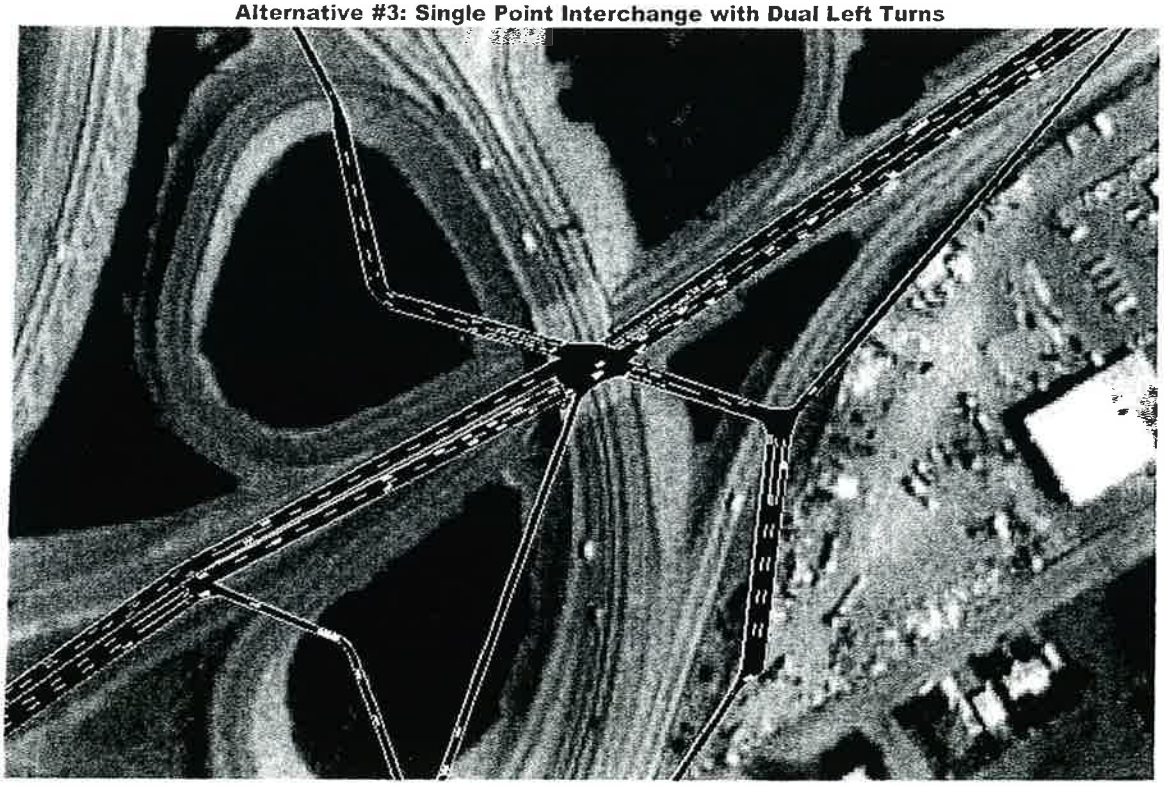
Table 3. Level of Service Analysis-Alternative #2: Diamond Interchange Single Left NB

Year	US 395 & NB Ramp		US 395 & SB Ramp	
	Weekday PM Peak		Weekday PM Peak	
	Control Delay (sec)	Level of Service	Control Delay (sec)	Level of Service
2029	53.2	D	32.5	C

While Alternative #2 meets minimum requirements for level of service, it should be noted that both ramp movements exhibit a level of service of LOS F. Also, at the NB ramp the WB queue is 1200' and the

A SimTraffic queuing analysis indicates the at the NB ramp the WB 95th percentile queue is 1200'. At the SB ramp the EB queue is 1000'. This alternative, while not rejected, operates poorly in the design year.

Alternative #3: Single Point Interchange with Dual Left Turns



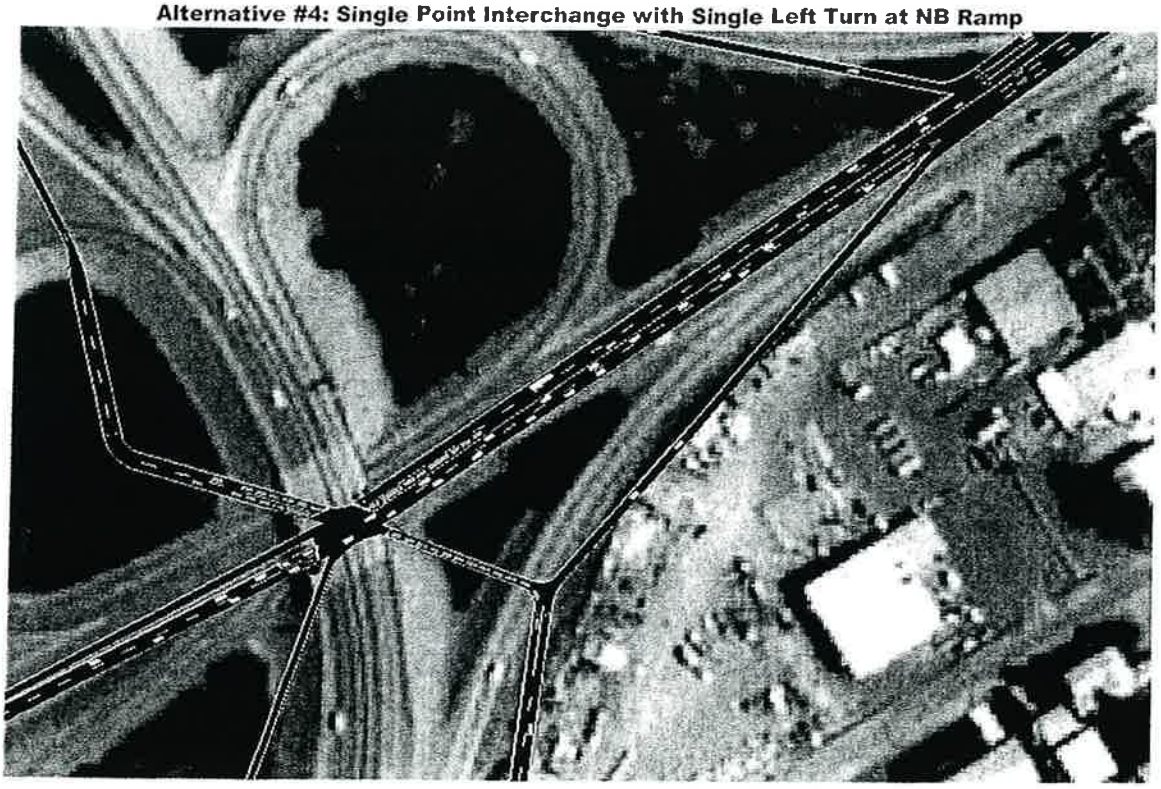
Alternative #3 involves the construction of a single point interchange with dual left turns at the NB and SB ramps. This would require 2 receiving lanes in the EB and WB direction. A WB left turn pocket would be installed and would provide for a protected left turn phase. The signals were evaluated and the Synchro level of service analysis is given in Table 4.

Table 4. Level of Service Analysis-Alternative #3: Single Point Interchange Dual Left Turns

	US 395 & NB/SB Ramp	
	Weekday PM Peak	
Year	Control Delay (sec)	Level of Service
2029	23.7	C

While Alternative #3 meets minimum requirements for level of service, it must be rejected because it is not feasible to construct. It requires 5 lanes at the US395 overcrossing to provide the necessary roadway section.

Alternative #4: Single Point Interchange with Single Left Turn at NB Ramp



Alternative #4 involves the construction of a single point interchange with dual left turns at the NB ramp and a single left turn at the SB ramp. This would require 2 receiving lanes in the EB direction and one receiving lane in the WB direction. A WB left turn pocket would be installed and would provide for a protected left turn phase. The signals were evaluated and the Synchro level of service analysis is given in Table 5.

Table 5. Level of Service Analysis-Alternative #4: Single Point Interchange Single Left Turn NB

	US 395 & NB/SB Ramp	
	Weekday PM Peak	
Year	Control Delay (sec)	Level of Service
2029	41.2	D

While Alternative #3 meets minimum requirements for level of service, there may be a couple fatal flaws in this proposal. First, the geometrics required to bring the ramps to a single point and redice vehicle speeds safely may not fit in the interchange footprint. Second, the US 395 overcrossing may be too low to install the necessary signal heads for a single point configuration. The displays need to be mounted to the bottom of the structure for the typical single point interchange signal and will be 1'-8" below the bottom of the structure. Further evaluation of the structure height would be necessary before this alternative can move forward.

Conclusions

An operational analysis of the four alternatives indicates only one alternative that would function well enough in the design year to be considered as effective as the roundabout alternative. However, while Alternative #4 has a lower overall delay than the two roundabouts, it will break down years before the proposed alternative. It may have fatal design flaws in terms of geometrics and structure height. Further examination of the potential flaws would be required before Alternative #4 should be considered.

Appendix A
Level of Service Reports and
Queue Analysis

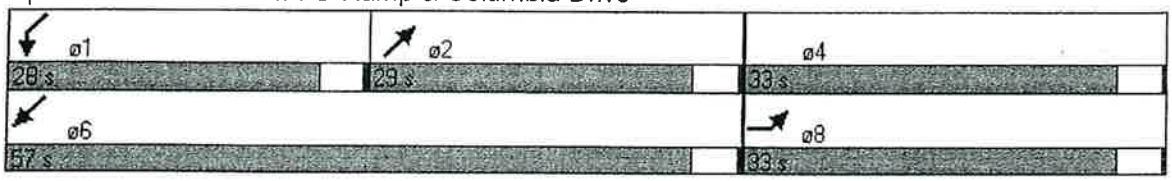
Lane Group	EBL	EBT	WBL	WBT	NBL	NET	SWL	SWT
Lane Configurations								
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	3303	0	1703	0	0	3406	1703	1792
Flt Permitted	0.950		0.950				0.950	
Satd. Flow (perm)	3303	0	1703	0	0	3406	1703	1792
Satd. Flow (RTOR)								
Volume (vph)	570	0	530	0	0	830	440	860
Adj. Flow (vph)	600	0	558	0	0	874	463	905
Lane Group Flow (vph)	600	0	558	0	0	874	463	905
Turn Type	Prot		custom				Prot	
Protected Phases	8					2	1	6
Permitted Phases			4					
Total Split (s)	33.0	0.0	33.0	0.0	0.0	29.0	28.0	57.0
Act Effct Green (s)	29.0		29.0			24.8	24.0	52.8
Actuated g/C Ratio	0.32		0.32			0.28	0.27	0.59
v/c Ratio	0.56		1.01			0.93	1.02	0.86
Uniform Delay, d1	25.1		30.4			31.6	32.9	15.4
Delay	25.5		66.7			41.5	72.9	19.5
LOS	C		E			D	E	B
Approach Delay		25.5		66.7		41.5		37.6
Approach LOS		C		E		D		D
Stops (vph)	455		641			813	548	689
Fuel Used(gal)	9		12			17	14	15
CO Emisions (g/hr)	645		834			1202	981	1064
NOx Emisions (g/hr)	125		162			234	191	207
VOC Emisions (g/hr)	149		193			279	227	246
Dilemma Vehicles (#)	0		0			44	0	44
Queue Length 50th (ft)	144		~325			253	~272	394
Queue Length 95th (ft)	197		#537			#371	#467	#679
Internal Link Dist (ft)		254		211	685	601		986
50th Up Block Time (%)			28%					
95th Up Block Time (%)			50%					
Turn Bay Length (ft)								
50th Bay Block Time %								
95th Bay Block Time %								
Queuing Penalty (veh)			217					

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 89.8	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.02	
Intersection Signal Delay: 41.2	Intersection LOS: D
Intersection Capacity Utilization 90.7%	ICU Level of Service E

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: NB Ramp & Columbia Drive



Intersection: 2: SB Ramp &

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: NB Ramp & Columbia Drive

Movement	EB	EB	WB	NE	NE	SW	SW
Directions Served	L	L	L	T	T	L	T
Maximum Queue (ft)	287	181	257	282	264	475	235
Average Queue (ft)	179	141	195	235	210	314	173
95th Queue (ft)	301	192	308	313	288	527	274
Link Distance (ft)	257	257	205	579	579	890	890
Upstream Blk Time (%)	0.03		0.14				
Queuing Penalty (veh)	0		72				
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 16: Bend

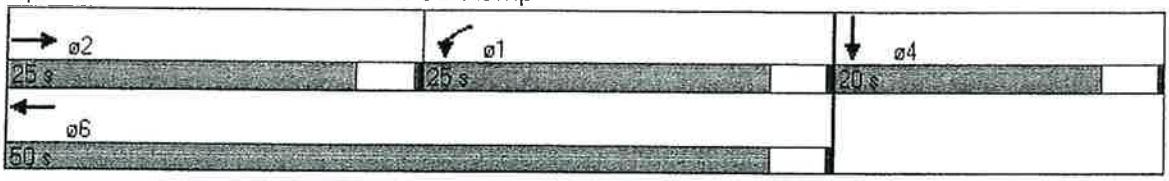
Movement	SB
Directions Served	T
Maximum Queue (ft)	375
Average Queue (ft)	143
95th Queue (ft)	433
Link Distance (ft)	396
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰	↑↑					↰	↲	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3406	1524	1703	3406	0	0	0	0	1618	1623	0
Flt Permitted				0.950						0.950	0.953	
Satd. Flow (perm)	0	3406	1524	1703	3406	0	0	0	0	1618	1623	0
Satd. Flow (RTOR)			739									
Volume (vph)	0	830	890	440	1390	0	0	0	0	570	5	0
Adj. Flow (vph)	0	874	937	463	1463	0	0	0	0	600	5	0
Lane Group Flow (vph)	0	874	937	463	1463	0	0	0	0	300	305	0
Turn Type			Free	Prot						Perm		
Protected Phases		2		1	6						4	
Permitted Phases			Free							4		
Total Split (s)	0.0	25.0	0.0	25.0	50.0	0.0	0.0	0.0	0.0	20.0	20.0	0.0
Act Effct Green (s)		21.7	70.0	21.0	46.7					15.3	15.3	
Actuated g/C Ratio		0.31	1.00	0.30	0.67					0.22	0.22	
v/c Ratio		0.83	0.61	0.91	0.64					0.85	0.86	
Uniform Delay, d1		22.4	0.0	23.5	6.8					26.2	26.3	
Delay		26.7	0.0	31.6	3.9					35.0	35.9	
LOS		C	A	C	A					D	D	
Approach Delay		12.9			10.6						35.5	
Approach LOS		B			B						D	
Stops (vph)		745	0	416	518					273	280	
Fuel Used(gal)		16	7	8	10					5	5	
CO Emisions (g/hr)		1136	459	533	719					345	355	
NOx Emisions (g/hr)		221	89	104	140					67	69	
VOC Emisions (g/hr)		263	106	124	167					80	82	
Dilemma Vehicles (#)		57	0	0	134					0	0	
Queue Length 50th (ft)		184	0	196	65					129	131	
Queue Length 95th (ft)		#284	0	m#312	95					#260	#265	
Internal Link Dist (ft)		943			445			313			113	
50th Up Block Time (%)										14%	15%	
95th Up Block Time (%)										48%	49%	
Turn Bay Length (ft)			400	400								
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)												

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow, Master Intersection
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 15.0 Intersection LOS: B
Intersection Capacity Utilization 76.6% ICU Level of Service C
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: SR 240 & SB Ramp

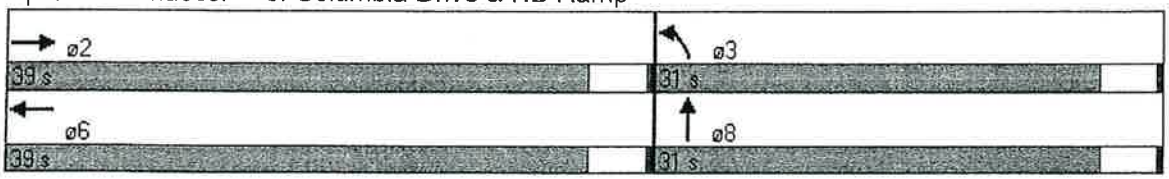


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑	↱	↰	↑	↱			
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	3406	0	0	3406	1524	1618	1623	1524	0	0	0
Flt Permitted							0.950	0.953				
Satd. Flow (perm)	0	3406	0	0	3406	1524	1618	1623	1524	0	0	0
Satd. Flow (RTOR)						653			20			
Volume (vph)	0	1400	0	0	1300	620	530	5	440	0	0	0
Adj. Flow (vph)	0	1474	0	0	1368	653	558	5	463	0	0	0
Lane Group Flow (vph)	0	1474	0	0	1368	653	279	284	463	0	0	0
Turn Type						Free	Prot		Perm			
Protected Phases		2			6		3	8				
Permitted Phases						Free			8			
Total Split (s)	0.0	39.0	0.0	0.0	39.0	0.0	31.0	31.0	31.0	0.0	0.0	0.0
Act Effct Green (s)		35.0			35.0	70.0	27.0	27.0	27.0			
Actuated g/C Ratio		0.50			0.50	1.00	0.39	0.39	0.39			
v/c Ratio		0.87			0.80	0.43	0.45	0.45	0.77			
Uniform Delay, d1		15.4			14.6	0.0	15.9	16.0	17.9			
Delay		6.1			15.2	0.0	16.5	16.6	21.8			
LOS		A			B	A	B	B	C			
Approach Delay		6.1			10.3			18.9				
Approach LOS		A			B			B				
Stops (vph)		721			1027	0	192	193	360			
Fuel Used(gal)		12			24	6	4	4	7			
CO Emisions (g/hr)		871			1693	415	270	274	497			
NOx Emisions (g/hr)		169			329	81	52	53	97			
VOC Emisions (g/hr)		202			392	96	63	64	115			
Dilemma Vehicles (#)		137			93	0	0	0	0			
Queue Length 50th (ft)		14			242	0	91	93	162			
Queue Length 95th (ft)		#146			328	0	157	161	#312			
Internal Link Dist (ft)		445			1248			70			131	
50th Up Block Time (%)							19%	20%	38%			
95th Up Block Time (%)							37%	37%	50%			
Turn Bay Length (ft)						500						
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)												

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 70
Offset: 6 (9%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 10.9 Intersection LOS: B
Intersection Capacity Utilization 76.1% ICU Level of Service C
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Columbia Drive & NB Ramp



Intersection: 2: Bend

Movement	SB	SB
Directions Served	T	
Maximum Queue (ft)	387	313
Average Queue (ft)	221	63
95th Queue (ft)	519	269
Link Distance (ft)	300	300
Upstream Blk Time (%)	0.05	0.00
Queuing Penalty (veh)	34	2
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 4: SR 240 & SB Ramp

Movement	EB	EB	WB	WB	WB	SB	SB	B14	B14	B15
Directions Served	T	T	L	T	T	L	LT	T	T	T
Maximum Queue (ft)	238	216	413	492	109	178	184	228	193	86
Average Queue (ft)	157	135	296	167	80	154	156	104	98	17
95th Queue (ft)	254	224	488	436	117	211	219	254	234	74
Link Distance (ft)	955	955		466	466	127	127	175	175	187
Upstream Blk Time (%)				0.02		0.56	0.57	0.07	0.00	
Queuing Penalty (veh)				17		0	0	0	0	
Storage Bay Dist (ft)			400							
Storage Blk Time (%)			0.04							
Queuing Penalty (veh)			27							

Intersection: 5: Bend

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 6: Columbia Drive & NB Ramp

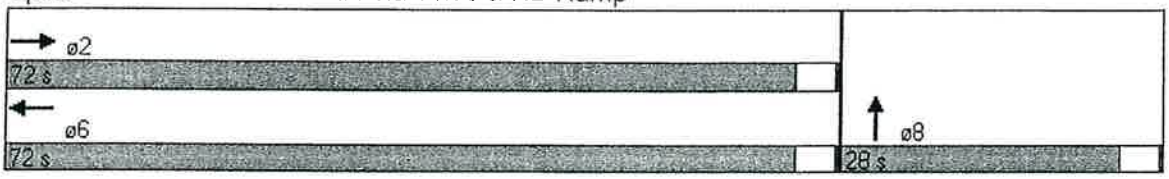
Movement	EB	EB	WB	WB	NB	NB	NB	B5	B5	B5
Directions Served	T	T	T	T	L	LT	R	T	T	T
Maximum Queue (ft)	108	92	270	168	134	148	153	30	50	56
Average Queue (ft)	66	56	194	133	110	106	104	6	10	17
95th Queue (ft)	133	114	271	180	153	143	176	25	43	55
Link Distance (ft)	466	466	1280	1280	86	86	86	169	169	169
Upstream Blk Time (%)					0.15	0.20	0.20			
Queuing Penalty (veh)					0	0	0			
Storage Bay Dist (ft)										
Storage Blk Time (%)										
Queuing Penalty (veh)										

Nework Summary

Network wide Queuing Penalty: 80

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 6: Columbia Drive & NB Ramp



Intersection: 2: Bend

Movement	SB	SB
Directions Served	T	
Maximum Queue (ft)	411	350
Average Queue (ft)	219	136
95th Queue (ft)	526	412
Link Distance (ft)	300	300
Upstream Blk Time (%)	0.06	0.01
Queuing Penalty (veh)	37	7
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 4: SR 240 & SB Ramp

Movement	EB	EB	EB	WB	WB	SB	SB	B14	B14	B15
Directions Served	T	T	R	L	T	L	LT	T	T	T
Maximum Queue (ft)	208	176	92	356	478	190	196	234	230	202
Average Queue (ft)	170	145	18	230	348	181	183	139	138	121
95th Queue (ft)	217	192	79	382	514	208	218	304	292	284
Link Distance (ft)	955	955			475	140	140	175	175	187
Upstream Blk Time (%)					0.01	0.69	0.64	0.33	0.12	0.31
Queuing Penalty (veh)					12	0	0	0	0	0
Storage Bay Dist (ft)			400	400						
Storage Blk Time (%)					0.01					
Queuing Penalty (veh)					7					

Intersection: 5: Bend

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 6: Columbia Drive & NB Ramp

Movement	EB	EB	WB	WB	NB	NB	B5	B5	B12	B11
Directions Served	T	T	T	R	LT	R	T	T	T	T
Maximum Queue (ft)	87	88	1308	524	137	145	241	241	258	308
Average Queue (ft)	32	24	614	105	134	144	240	192	235	222
95th Queue (ft)	81	80	1202	450	137	146	241	237	274	420
Link Distance (ft)	475	475	1286		87	87	169	169	186	290
Upstream Blk Time (%)			0.02		0.78	0.41	0.67	0.29	0.50	0.32
Queuing Penalty (veh)			0		0	0	0	0	0	0
Storage Bay Dist (ft)				500						
Storage Blk Time (%)			0.04	0.00						
Queuing Penalty (veh)			24	0						

Intersection: 11: Bend

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 12: Bend

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Nework Summary

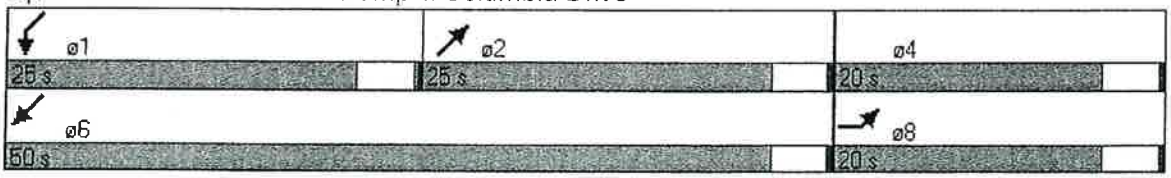
Network wide Queuing Penalty: 87

Lane Group	EBL	EBT	WBL	WBT	NBL	NET	SWL	SWT
Lane Configurations								
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	3303	0	3303	0	0	3406	1703	1792
Flt Permitted	0.950		0.950				0.950	
Satd. Flow (perm)	3303	0	3303	0	0	3406	1703	1792
Satd. Flow (RTOR)								
Volume (vph)	570	0	530	0	0	830	440	860
Adj. Flow (vph)	600	0	558	0	0	874	463	905
Lane Group Flow (vph)	600	0	558	0	0	874	463	905
Turn Type	Prot		custom				Prot	
Protected Phases	8					2	1	6
Permitted Phases			4					
Total Split (s)	20.0	0.0	20.0	0.0	0.0	25.0	25.0	50.0
Act Effct Green (s)	15.0		15.0			19.6	19.8	43.5
Actuated g/C Ratio	0.23		0.23			0.29	0.30	0.65
v/c Ratio	0.81		0.75			0.87	0.91	0.77
Uniform Delay, d1	24.4		24.0			22.1	22.5	8.0
Delay	28.1		25.7			26.8	38.1	9.1
LOS	C		C			C	D	A
Approach Delay		28.1		25.7		26.8		18.9
Approach LOS		C		C		C		B
Stops (vph)	514		468			747	437	569
Fuel Used(gal)	10		7			14	10	12
CO Emisions (g/hr)	688		459			995	705	873
NOx Emisions (g/hr)	134		89			194	137	170
VOC Emisions (g/hr)	160		106			230	163	202
Dilemma Vehicles (#)	0		0			59	0	59
Queue Length 50th (ft)	125		115			184	190	229
Queue Length 95th (ft)	#200		167			#284	#357	386
Internal Link Dist (ft)		254		211	685	601		986
50th Up Block Time (%)								
95th Up Block Time (%)								
Turn Bay Length (ft)								
50th Bay Block Time %								
95th Bay Block Time %								
Queuing Penalty (veh)								

Intersection Summary	
Cycle Length: 70	
Actuated Cycle Length: 66.6	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.91	
Intersection Signal Delay: 23.7	Intersection LOS: C
Intersection Capacity Utilization 76.9%	ICU Level of Service C

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: SB Ramp & Columbia Drive



Intersection: 2: SB Ramp &

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: SB Ramp & Columbia Drive

Movement	EB	EB	WB	WB	NE	NE	SW	SW
Directions Served	L	L	L	L	T	T	L	T
Maximum Queue (ft)	226	180	119	144	247	226	358	193
Average Queue (ft)	152	149	82	92	178	161	245	132
95th Queue (ft)	214	181	134	154	239	235	378	202
Link Distance (ft)	240	240	194	194	579	579	887	887
Upstream Blk Time (%)	0.00							
Queuing Penalty (veh)	0							
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 16: Bend

Movement	SB	SB
Directions Served	T	
Maximum Queue (ft)	434	396
Average Queue (ft)	250	79
95th Queue (ft)	588	340
Link Distance (ft)	396	396
Upstream Blk Time (%)	0.03	0.00
Queuing Penalty (veh)	22	2
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

DESIGN

DECISIONS

Project Design Criteria
Ramps & Collector Distributors

Matrix 4 ***Row 10***

This checklist is to confirm interpretation of standards. Your project may require that additional/different/or fewer Design Elements be addressed.

Design Class	MDL-4 (Based on Project Analysis)
Functional Class	Urban Principal Arterial
Design Year	2029
Design Speed	45 MPH
AADT	84000
Truck Percentage	5.5%
Right of Way Width	Varies as needed for cross section elements. See DM Figure 440-5a & 5b (May 2006)

DESIGN ELEMENT	**Design Level (B/M/F)**	**Standard**	***REFERENCE & COMMENTS***
Horizontal Alignment	F		
Stopping Sight Distance		360'	DM Figure 650-1 (May 2006)
Max. Superelevation		10%	DM 642.04 (January 2005)
Vertical Alignment	F		
Maximum Grade		7%	DM Figure 440-6a (May 2007) for mainline in urban area and DM Figure 940-2 (January 2005) for ramp
Stopping Sight Distance		360'	DM Figure 650-11 & 12 (May 2006)
Passing Sight Distance		1625'	DM Figure 650-9 (May 2006)
Decision Sight Distance		800'	DM Figure 650-10 (May 2006)
Lane Width	F		
Number of Lanes		4	DM Figure 440-6a (May 2007)
Lane Width		12'	DM Figure 440-6a (May 2007)
Turning Roadway Width		Varies	DM Figure 641-2a (January 2005)
Shoulder Width	F		
Shoulder Width-Inside		Varies 1-4'	DM Figure 440-2 & 3, 6a & 6b (May 2007), DM 641.04 (5) (November 2006) for mainline DM 940-3 (2005) for ramp
Shoulder Width-Outside		Varies 1-10'	DM Figure 440-2 & 3, 6a & 6b (May 2007), DM 641.04 (5) (November 2006) for mainline DM 940-3 (2005) for ramp

DESIGN ELEMENT	Design Level (B/M/F)	Standard	REFERENCE & COMMENTS
Lane Transition	F		
Channelization Tapers		L=VT	DM 620.07 (January 2005)
On/Off Connections	F		DM 940.06 (4) & (5), DM Figure 940-8, 9b, 10, 12a, 12b (September 2002) DM Figure 940-11a, 11b (January 2005)
Cross Slope Lane	F	2%	DM 640.04 (1) (November 2006)
Cross Slope Shoulder	F	2%	DM 640.04 (3) (November 2006), up 6% w/ justification
Fill/Ditch Slopes	F		
Fill Slopes		Varies	DM Figure 640-1 (November 2006)
Ditch In-slopes		Varies	DM Figure 640-1 (November 2006)
Access	F		DM Chapter 1430 (May 2007)
Clear Zone	F	Varies	DM Figure 700-1 (May 2006)
Signing	F		DM Chapter 820 (November 1999)
Delineation	F		DM Chapter 830 (May 2006)
Illumination	F		DM Chapter 840 (November 2006)
Basic Safety	Blank		
Vertical Clearance	F		DM Chapter 1120 (May 2007)
Bridge # 395/38S-S		16.5'	DM Figure 1120-1, for new bridge
Bicycles	F		DM Chapter 1020 (November 2006)
Pedestrians	F		DM Chapter 1025 (May 2006)
Ramp Terminals	F		
Design Vehicle		WB-67	DM Figure 910-3 (May 2006). Also, WB-67 is used for design analysis for both roundabouts
Turn Radii	F		
Intersection Radii - Left		50	DM Figure 910-10a through 10e (May 2006), N/A for roundabout design

DESIGN ELEMENT	Design Level (B/M/F)	Standard	REFERENCE & COMMENTS
Intersection Radii - Right		55	DM Figure 910-7 (January 2005), N
Intersection Angle	F	90	DM 910.04 (2) (a) (May 2006), required limits (75°-105°)
Intersection Sight Distance	F	Varies	DM Figure 910-17a & 17b (May 2006)
Barriers			
Terminals & Transition Sections	F		DM Chapter 710 (November 2006)
Standard Run	F		DM Chapter 710 (November 2006)
Bridge Rail	F		DM Chapter 710 (November 2006), N/A

Project Design Criteria
Mainline – US 395 & SR 240

Matrix 3 ***Row*** 11

This checklist is to confirm interpretation of standards. Your project may require that additional/different/or fewer Design Elements be addressed.

Design Class	MDL-4 (Based on Project Analysis)
Functional Class	Urban Principal Arterial
Design Year	2029
Design Speed	45 MPH
AADT	84000
Truck Percentage	5.5%
Right of Way Width	Varies as needed for cross section elements. See DM Figure 440-5a & 5b (May 2006)

DESIGN ELEMENT	**Design Level (B/M/F)**	**Standard**	***REFERENCE & COMMENTS***
Horizontal Alignment	F		
Stopping Sight Distance		360'	DM Figure 650-1 (May 2006)
Max. Superelevation		10%	DM 642.04 (November 2007)
Vertical Alignment	F		
Maximum Grade		7%	DM Figure 440-6 (November 2007)
Stopping Sight Distance		360'	DM Figure 650-1 (May 2006)
Passing Sight Distance		1625'	DM Figure 650-9 (May 2006)
Decision Sight Distance		800'	DM Figure 650-10 (May 2006)
Lane Width	F		
Number of Lanes		4	DM Figure 440-6 (November 2007)
Lane Width		12'	DM Figure 440-6 (November 2007)
Turning Roadway Width		Varies	DM Figure 641-2a (November 2006)
Shoulder Width	F		
Shoulder Width-Inside		Varies 1-4'	DM Figure 440-3 & 6 (November 2007)
Shoulder Width-Outside		Varies 1-10'	DM Figure 440-3 & 6 (November 2007)
Lane Transition	F		
Channelization Tapers		L=VT	DM 620.07 (January 2005)

DESIGN ELEMENT	Design Level (B/M/F)	Standard	REFERENCE & COMMENTS
On/Off Connections	F		DM 940.06 (4) & (5)
Median Width	F	Varies	Figure 440-4 & 6 (November 2007)
Cross Slope Lane	F	2%	DM 640.04 (1) (November 2006)
Cross Slope Shoulder	F	2%	DM 640.04 (3) (November 2006), up to 6% w/ justification
Fill/Ditch Slopes	F		
Fill Slopes		Varies	DM Figure 640-1 (November 2006)
Ditch In-slopes		6:1	DM Figure 640-1 (November 2006)
Access	F		DM Chapter 1430 (November 2007)
Clear Zone	F	Varies	DM Figure 700-1 (May 2006)
Signing	F		DM Chapter 820 (November 1999)
Delineation	F		DM Chapter 830 (May 2006)
Illumination	F		DM Chapter 840 (November 2006)
Basic Safety	Blank		
Bicycles	F		DM Chapter 1020 (November 2006)
Pedestrians	F		DM Chapter 1025 (May 2006)
Bridges			
Lane Width	F		
Bridge # 395/38S-S			
Number of Lanes		3	DM Figure 440-6 (November 2007)
Lane Width		12'	DM Figure 440-6 (November 2007)
Shoulder Width	F		
Bridge # 395/38S-S			
Shoulder Width-Inside		4'	DM Figure 440-6 (November 2007)
Shoulder Width-Outside		8'	Figure 940-3 (January 2005), shoulder is part of off-ramp

DESIGN ELEMENT	Design Level (B/M/F)	Standard	REFERENCE & COMMENTS
Vertical Clearance	F		DM Chapter 1120 (May 2007)
Bridge # 395/38S-S		16.5'	DM Figure 1120-1, for new bridge
Structural Capacity	F		
Bridge # 395/38S-S		HL-93	DM 1120.04 (1) (a) (May 2007)
Intersections	F		
Design Vehicle		WB-67	DM Figure 910-5 (November 2007). Also, WB-67 is used for roundabout design analysis.
Turn Radii	F		
Intersection Radii - Left		50	DM Figure 910-14a through 14e (November 2007
Intersection Radii - Right		70	DM Figure 910-11 (November 2007
Intersection Angle	F	90	DM 910.05 (2) (November 2007)
Intersection Sight Distance	F	Varies	DM Figure 910-22a (November 2007)
Barriers			
Terminals & Transition Sections	F		DM Chapter 710 (November 2006)
Standard Run	F		DM Chapter 710 (November 2006)
Bridge Rail	F		DM Chapter 710 (November 2006), N/A

GEOMETRIC

DATA

SPREADSHEET

Project Name: US 395/Columbia Drive to SR 240 Interchange Rebuild

Roundabout Design Parameters

Current as of 11-07-2007

This checklist is to confirm interpretation of standards. Your project may require that additional/different/or fewer Design Elements be addressed.

Design Data			
Design Class	Multilane Roundabout		
Design Year	2029		
Mainline Posted Speed (Design Speed)	Columbia Drive 35 mph (35 mph) westbound; 60 mph eastbound (70 mph)		
Cross Road Posted Speed (Design Speed)	US 395 45 mph (45 mph) (grade separated)		
Traffic Analysis	Completed July 2007		
Conceptual Approval	Approved September 6, 2007		
Geometric Approval			
	Reference/Date	**Design Performance Objective**	**Determination**
Design Vehicle Turning Path	DM 915.06(2)(a)	WB-67: use both lanes	Meets standard
	May-07		
Fastest Vehicle Paths	DM 915.06(2)(b)	All paths less than 25 mph, and less than 6 mph speed	Meets standard
	May-07	difference between consecutive & conflicting movements	
Natural Vehicle Paths	DM 915.06(2)(c)	Smooth path without path overlap	Meets standard
	May-07		
Design Components		Teardrop Roundabout	
Inscribed Circle Diameter (ICD)	DM 915.06(3)(a)	Meet capacity and relevant paths (turning, fastest, natural)	210' W, 175' E
	May-07	150' minimum for 2-lane	
Approach Alignment	DM 915.06(3)(b)	Provide deflection	Meets standard
	May-07		
Entry	DM 915.06(3)(c)	Smooth entry path; no pedestrians present	Meets standard
	May-07		
Exit	DM 915.06(3)(d)	Smooth right-turn and exit paths; no pedestrians present	Meets standard
	May-07		
Central Island Diameter	DM 915.06(3)(a)	= ICD - [(lane width)*(# lanes)] - (truck apron width, if any)	Meets standard
	May-07		
Truck Apron	DM 915.06(3)(a)	Multi-lane, not needed with supporting paths	6' for overiszed veh.
	May-07		
Superelevation and Grades	DM 915.06(3)(f)	-2% cross slope; ±2% longitudinal grade desirable, ±4% max	Meets standard, 4%
	May-07		
Clear Zone	DM 915.06(3)(g)	Clear zone distance related to fastest path speeds	Meets standard 10'
	May-07		

Updated: 5 - 2007 ks
Adapted: 8 - 2007 jj

Project Name: US 395/Columbia Drive to SR 240 Interchange Rebuild

Roundabout Design Parameters Continued

This checklist is to confirm interpretation of standards. Your project may require that additional/different/or fewer Design Elements be addressed.

Current as of 11-07-2007

Design Element	**Reference/ Date**	**Design Performance Objective (West Roundabout)**				**Determination**
Approach From...		North	West	West-Slip	East-Half	
Design Vehicle	DM 910.05	WB-67	WB-67	WB-67	WB-67	Truck Route
	May-07					
R1 - Entry Path Radius		100'	100'	N/A	125'	
Superelevation		+2%	+2%	N/A	+2%	
Speed (mph)	DM fig 915-9	21 mph	21 mph	N/A	23 mph	Meets Standard
	May-07					
R2 - Circulating Path Radius		115'	100'	N/A	125'	
Superelevation		-2%	-2%	N/A	-2%	
Speed (mph)	DM fig 915-10	20 mph	19 mph	N/A	21 mph	Meets Standard
	May-07					
R3 - Exit Path Radius (1)		>200'	N/A	N/A	>>200'	
Superelevation		+2%	N/A	N/A	-2%	
Speed (mph)	DM fig 915-11	(note 1)	N/A	N/A	(note 1)	Standard, see note 1
	May-07					
R4 - Left Turn Path Radius		75'	N/A	N/A	80'	
Superelevation		-2'	N/A	N/A	-2%	
Speed (mph)	DM fig 915-12	18 mph	N/A	N/A	18 mph	Meets Standard
	May-07					
R5 - Right Turn Path Radius		100'	90'	115'	N/A	
Superelevation		+2%	+2%	+2%	N/A	
Speed (mph)	DM fig 915-13	21 mph	20 mph	22 mph	N/A	Meets Standard
	May-07					
Approach Stopping Sight Distance (2)	DM fig 915-21	119'	119'	N/A	131'	N/A no crosswalk
Circulating Stopping Sight Distance (2)	DM fig 915-22	112'	104'	N/A	119'	Meets Standard
Exit Stopping Sight Distance (2)	DM fig 915-23	N/A	N/A	N/A	N/A	N/A no crosswalk
S1 - Entering Stream Sight Distance (2)	DM fig 915-24	136'	132'	N/A	144'	Meets Standard
S2- Circulating Stream Sight Distance (2)	DM fig 915-24	116'	N/A	N/A	116'	Meets Standard
	May-07					

Note 1: Exit speed controlled by circulating speed plus acceleration; Note 2: Sight distances correspond to the column rather than the intersection

Updated: 5 - 2007 ks
Adapted: 8 - 2007 jj

Project Name: US 395/Columbia Drive to SR 240 Interchange Rebuild

Roundabout Design Parameters Continued

Current as of 11-07-2007

This checklist is to confirm interpretation of standards. Your project may require that additional/different/or fewer Design Elements be addressed.

Design Element	**Reference/ Date**	**Design Performance Objective (East Roundabout)**				**Determination**
Approach From...		East	South	South Slip	West-half	
Design Vehicle	DM 910.05	WB-67	WB-67	WB-67	WB-67	Truck Route
	May-07					
R1 - Entry Path Radius		115'	150'	125'	125'	
Superelevation		+2%	-2%	-2'	+2%	
Speed (mph)	DM fig 915-9	22 mph	23 mph	21 mph	23 mph	Meets Standard
	May-07					
R2 - Circulating Path Radius		75'	60'	N/A	100'	
Superelevation		-2%	-2%	N/A	-2%	
Speed (mph)	DM fig 915-10	18 mph	17 mph	N/A	19 mph	Meets Standard
	May-07					
R3 - Exit Path Radius (1)		>200'	N/A	N/A	>>200'	
Superelevation		+2%	N/A	N/A	-2%	
Speed (mph)	DM fig 915-11	(note 1)	N/A	N/A	(note 1)	Standard, see note 1
	May-07					
R4 - Left Turn Path Radius		N/A	60'	N/A	60'	
Superelevation		N/A	-2%	N/A	-2%	
Speed (mph)	DM fig 915-12	N/A	17 mph	N/A	17 mph	Meets Standard
	May-07					
R5 - Right Turn Path Radius		N/A	N/A	125'	N/A	
Superelevation		N/A	N/A	+2%	N/A	
Speed (mph)	DM fig 915-13	N/A	N/A	23 mph	N/A	Meets Standard
	May-07					
Approach Stopping Sight Distance (2)	DM fig 915-21	127'	131'	119'	131'	N/A no crosswalk
Circulating Stopping Sight Distance (2)	DM fig 915-22	94'	87'	N/A	104'	Meets Standard
Exit Stopping Sight Distance (2)	DM fig 915-23	N/A	N/A	N/A	N/A	N/A no crosswalk
S1 - Entering Stream Sight Distance (2)	DM fig 915-24	131'	129'	N/A	137'	Meets Standard
S2- Circulating Stream Sight Distance (2)	DM fig 915-24	N/A	109'	N/A	109'	Meets Standard
	May-07					

Note 1: Exit speed controlled by circulating speed plus acceleration; Note 2: Sight distances correspond to the column rather than the intersection

Updated: 5 - 2007 ks
Adapted: 8 - 2007 jj

Project Name: US 395/Columbia Drive to SR 240 Interchange Rebuild

Roundabout Design Parameters Continued

Current as of 11-07-2007

This checklist is to confirm interpretation of standards. Your project may require that additional/different/or fewer Design Elements be addressed.

	Reference/Date	Design Performance Objective	Determination
Right-Turn Slip Lane	DM 915.06(3)(i)	Provide as needed by traffic analysis	West and South
	May-07		Entries
Add and Drop or Bypass Lane	DM 915.06(3)(j)	Provide as needed by traffic analysis	North and South
	May-07		Entries
Railroad Crossing	DM 915.06(3)(k)	No railroads near this roundabout	N/A no railroad
	May-07		
Pedestrians	DM 915.07	No pedestrians allowed in interchange area	N/A no pedestrians
	May-07		
Bicycles	DM 915.08	No bicycles allowed in interchange area	N/A no bicycles
	May-07		
Signing and Pavement Marking	DM 915.09	Provide signing and pavement markings per the MUTCD	Meets Standard
	May-07		
Illumination	DM 915.10	Provide illumination at each conflict point and at curb	Meets Standard
	May-07	terminals	
Access, Parking and Transit Facilities	DM 915.11	No access, or parking, or transit stops within the corner	Meets Standard
	May-07	clearance distance	

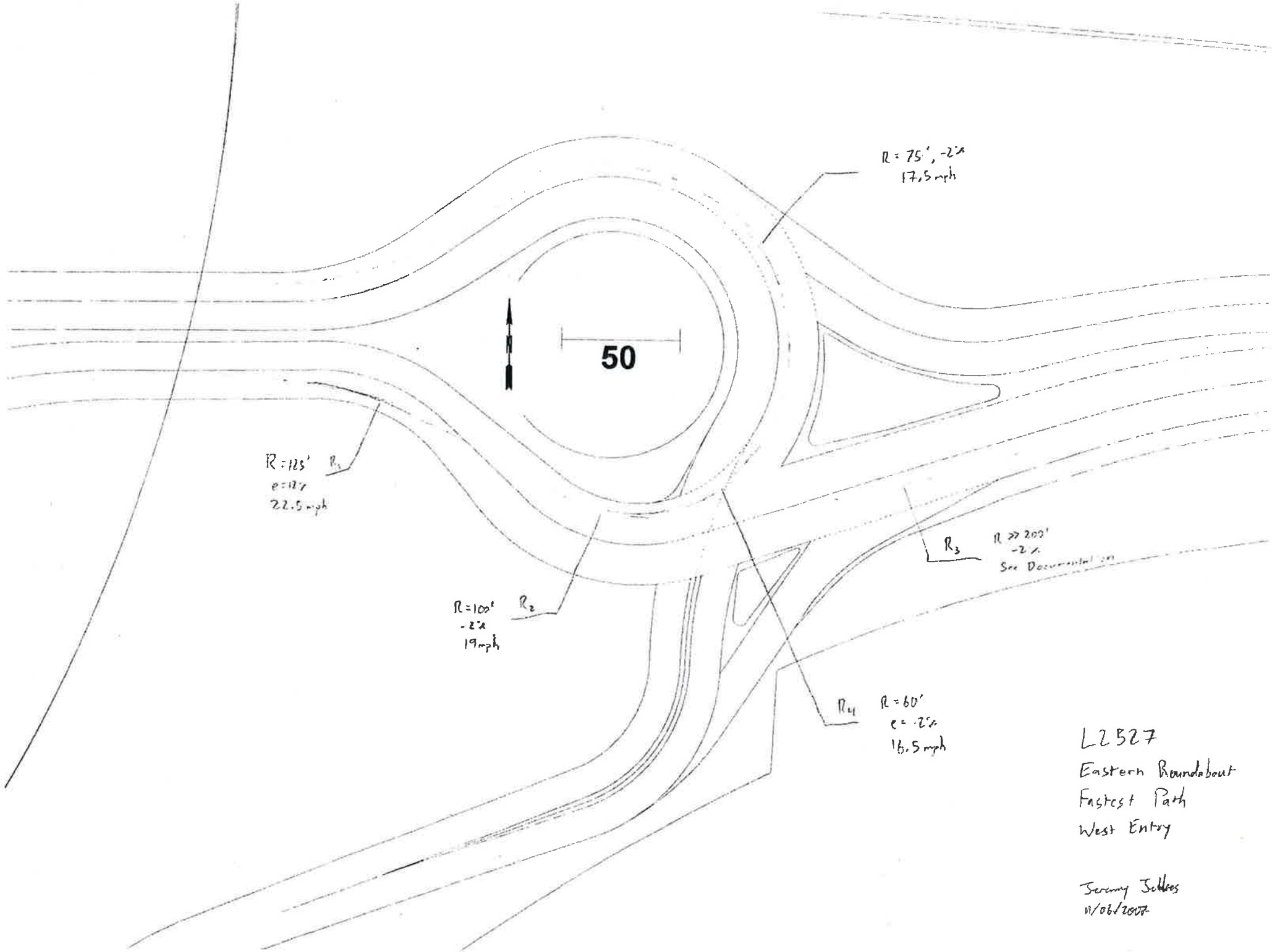
Updated: 5 - 2007 ks
Adapted: 8 - 2007 jj

FASTEST

NATURAL

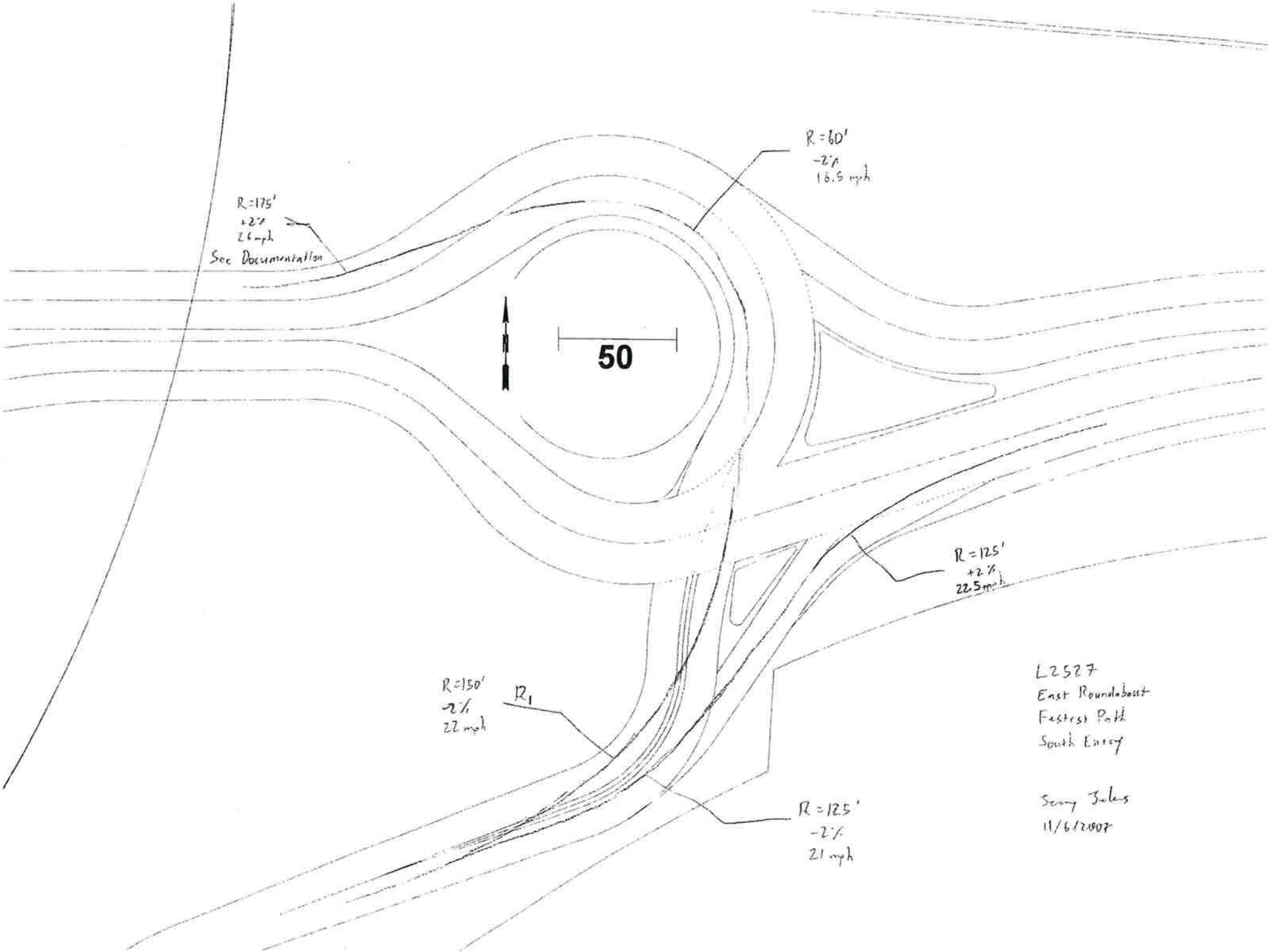
AND TRUCK

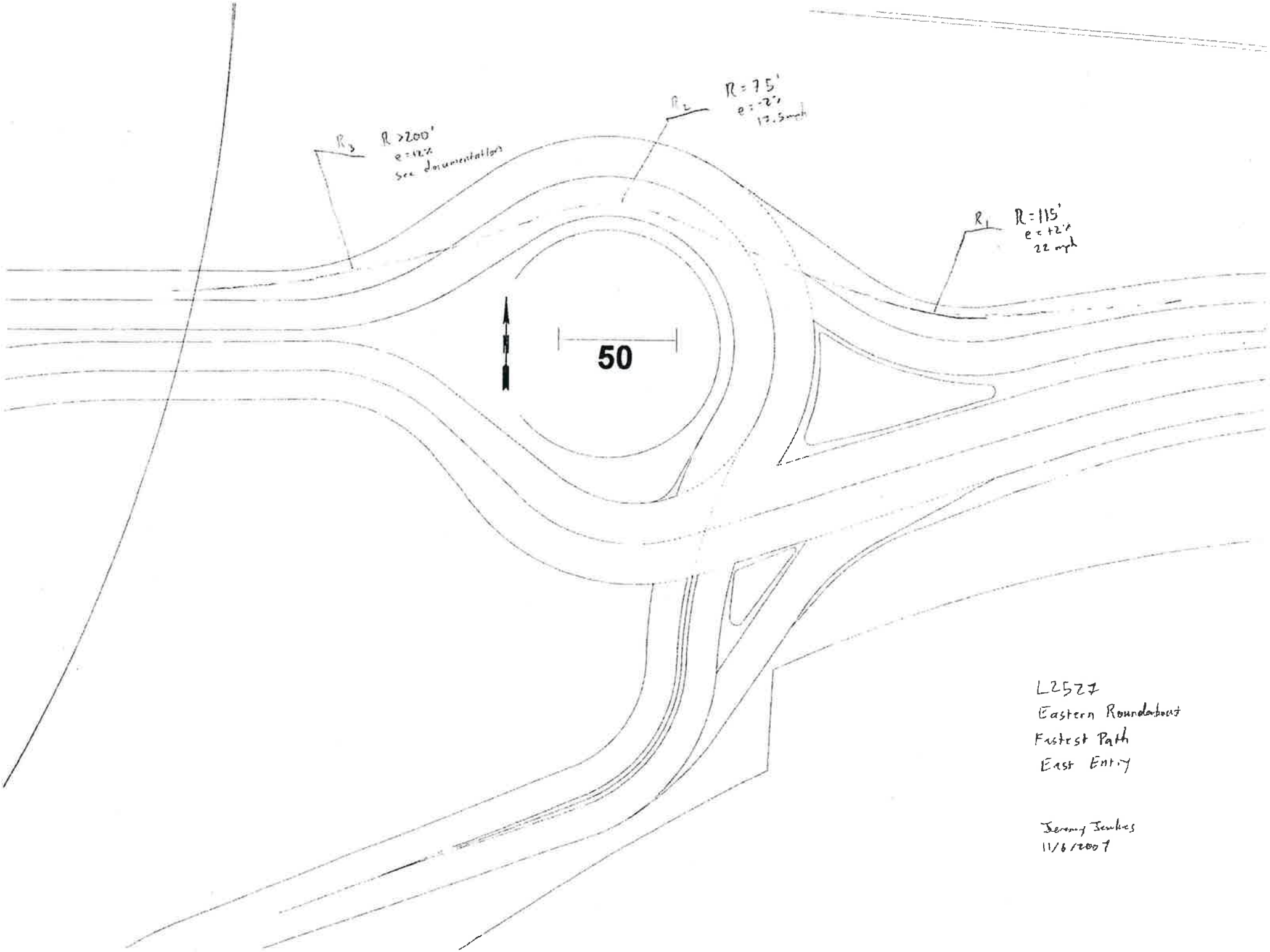
TURNING PATHS



L2527
Eastern Roundabout
Fastest Path
West Entry

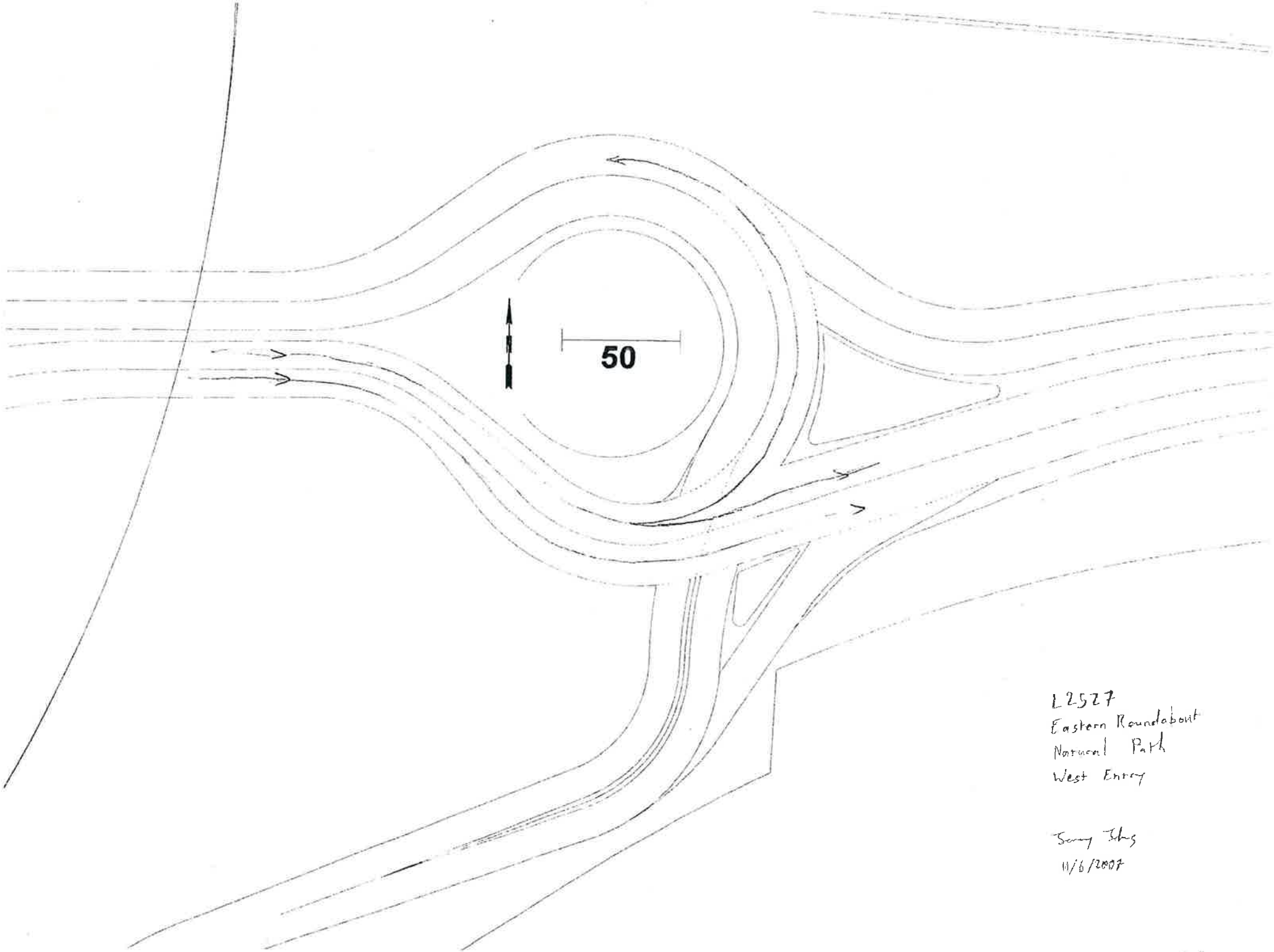
Jeremy Sellers
11/06/2007


R=60'
-2%
16.5 mph
R=175'
+2%
26 mph
See Documentation
50
R=125'
+2%
22.5 mph
R=150'
-2%
22 mph
R1
R=125'
-2%
21 mph
L2527
East Roundabout
Fastest Path
South Entry
Sean Sales
11/6/2007



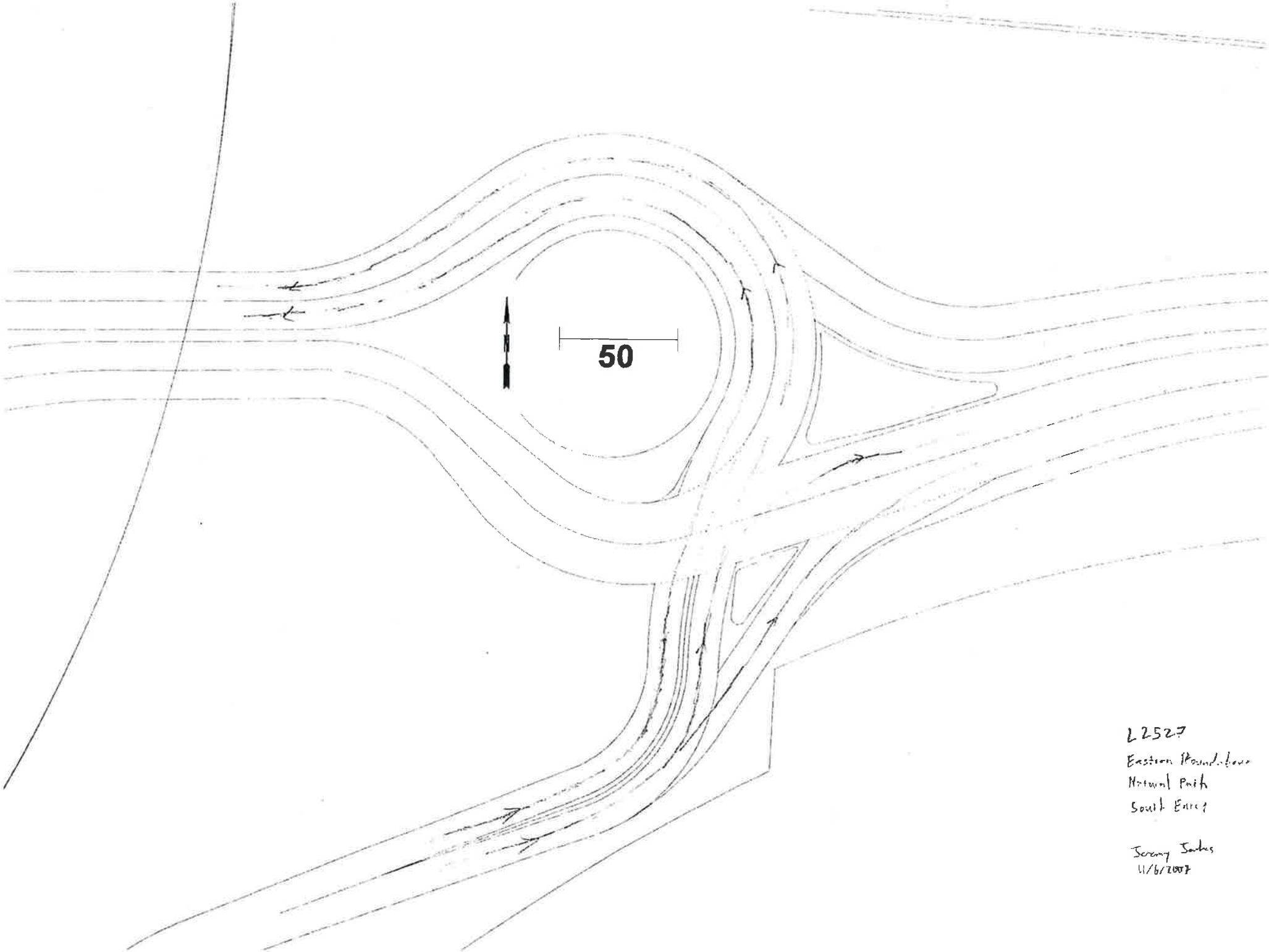
L2527
Eastern Roundabout
Fastest Path
East Entry

Jeremy Jenkins
11/6/2007



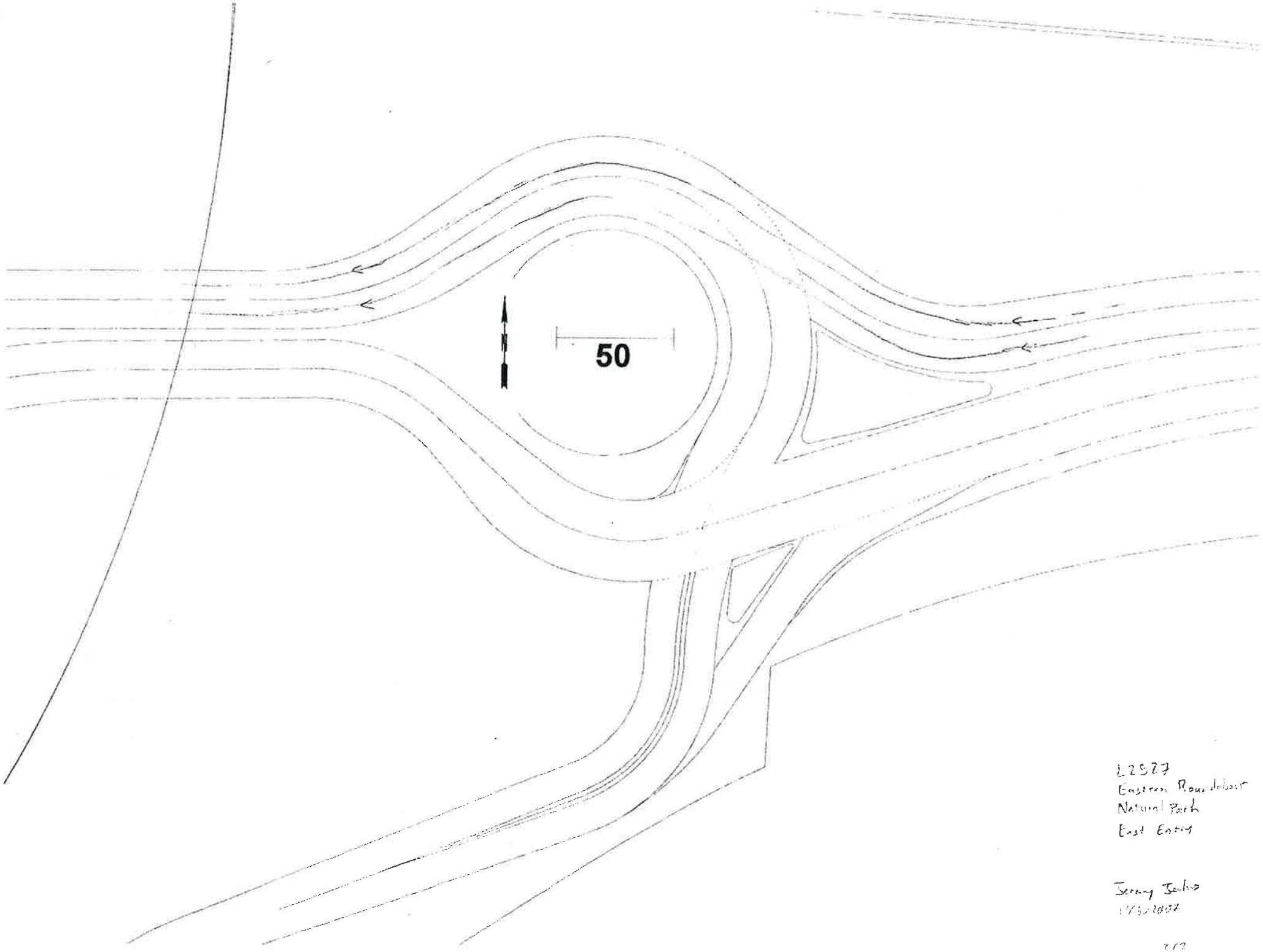
L2527
Eastern Roundabout
Natural Path
West Entry

Survey Tubs
11/6/2007



L2527
Eastern Roundabout
Natural Path
South Entry

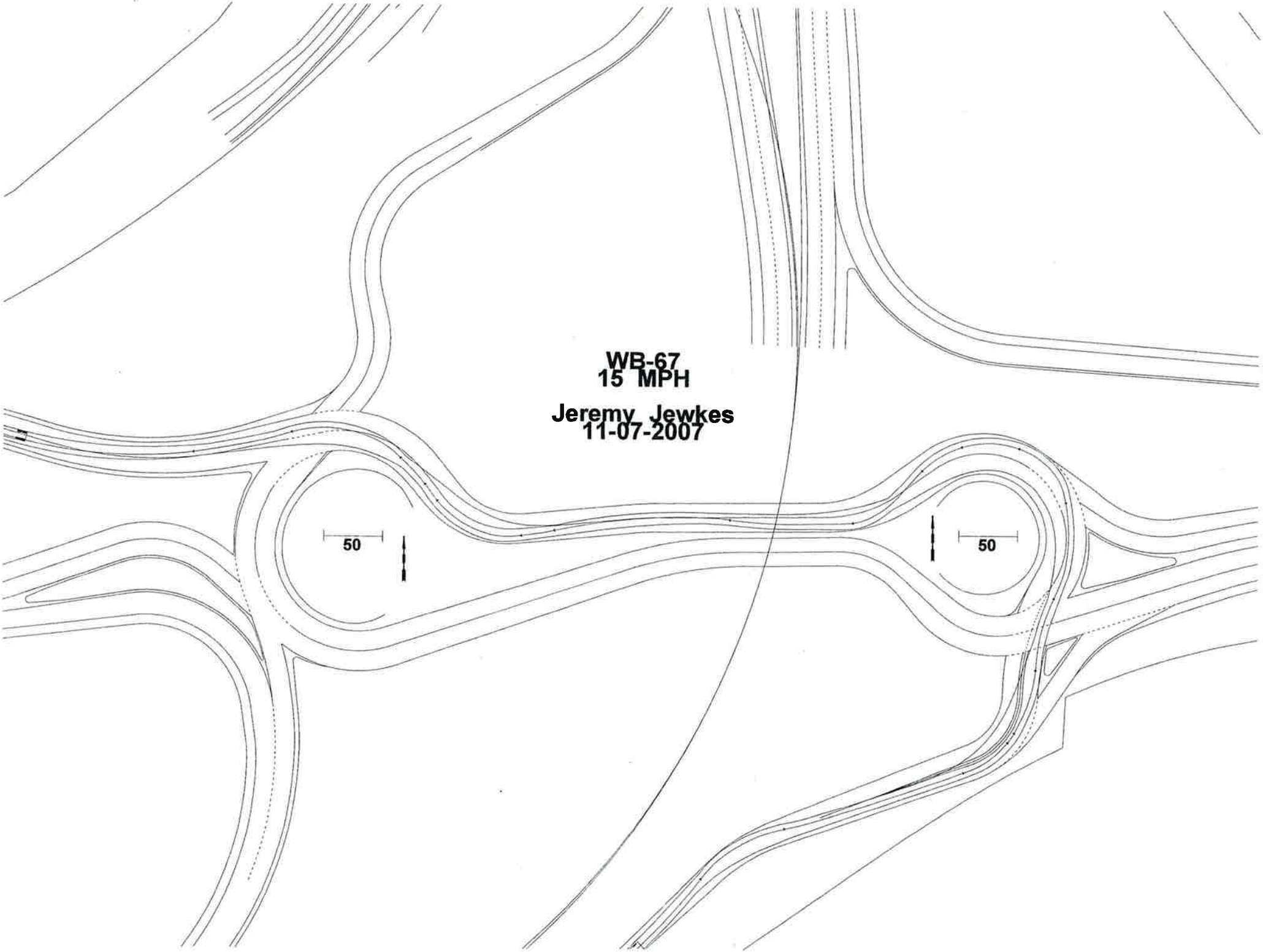
Jeremy Sanders
11/6/2007



L2527
Eastern Roundabout
Natural Path
East Entry

Jeremy Jenkins
17/12/2007


WB-67
15 MPH
Jeremy Jewkes
11-07-2007
50
50


WB-67
15 MPH
Jeremy Jewkes
11-07-2007
50
50


WB-67
15 MPH
Jeremy Jewkes
11-07-2007
50
50


WB-67
15 MPH
Jeremy Jewkes
11-07-2007
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WB-67
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Jeremy Jewkes
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WB-67
15 MPH
Jeremy Jewkes
11-07-2007
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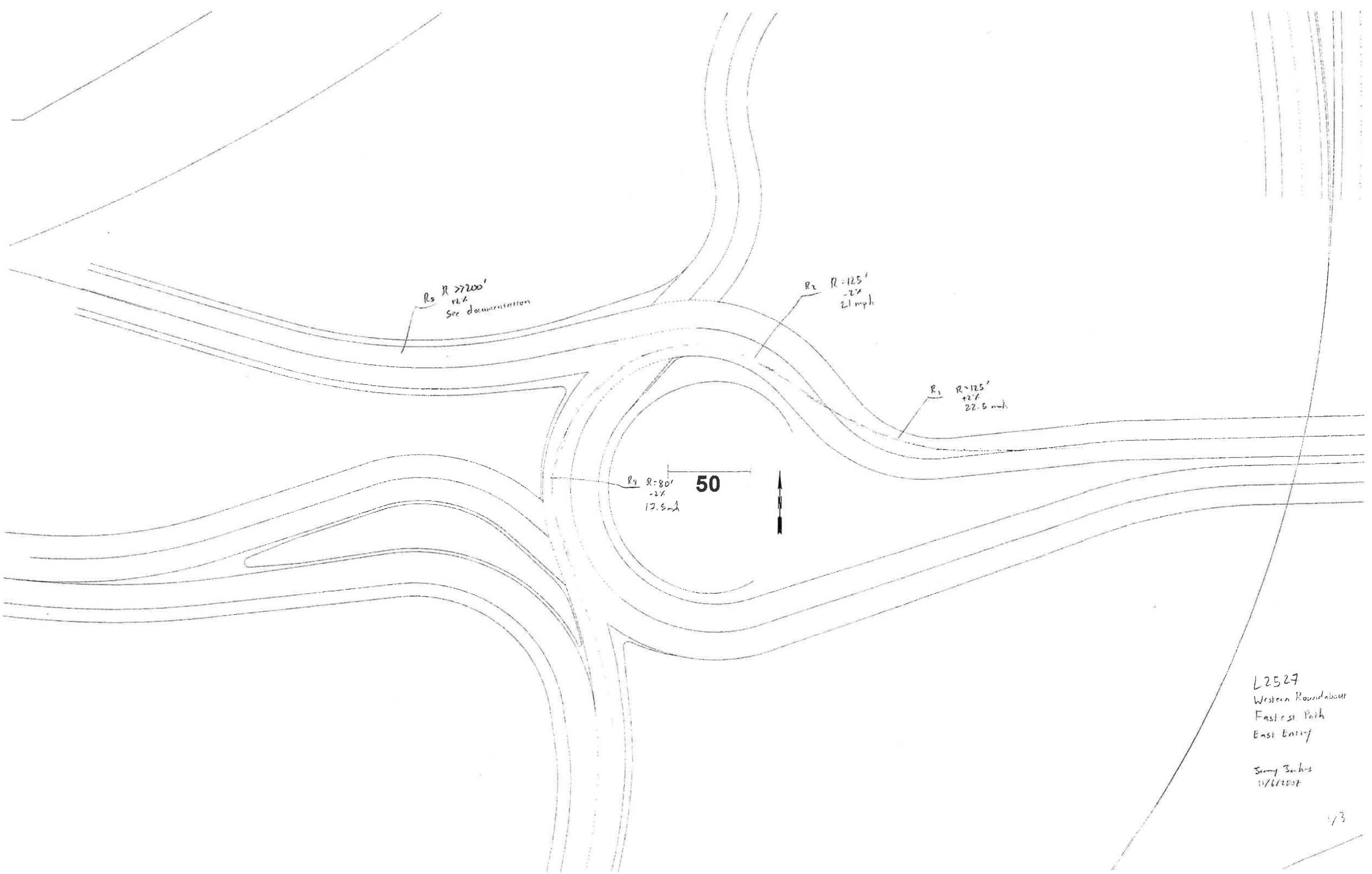


L2527
Western Roundabout
Fastest Path
East Entry

Jenny Barbas
11/6/2007

1/3

R_5 R >7200'
+2%
See documentation

R_2 R=125'
-2%
21 mph

R_1 R=125'
+2%
22.5 mph

R_4 R=80'
-2%
17.5 mph

50

L2527
Western Roundabout
East-st Path
East Entry

Jeremy Jenkins
11/6/2007

1/3

50

N

L2522
Western Roundabout
Natural Path
North Entry

Jeremy Sachs
11/6/2007

50

L2527
Western Roundabout
Natural Park
West Entry

Jenny Jacks
11/6/2007

3/3

R = 100'
+2%
21 mph

R_1

R=100'
+2%
21 mph

R_5

R= 115'
-2%
20 mph

R_2

50

R_4 R=75'
-2%
17.5 mph

R >200'
+2%
See documentation

R_3

L2527
Western Roundabout
Eastern Path
North Entry

Sammy Sachs
11/6/2007

50

N

L2527
Western Roundabout
Natural Path
East Entry

Tony Schibig
1/6/2017

1/3

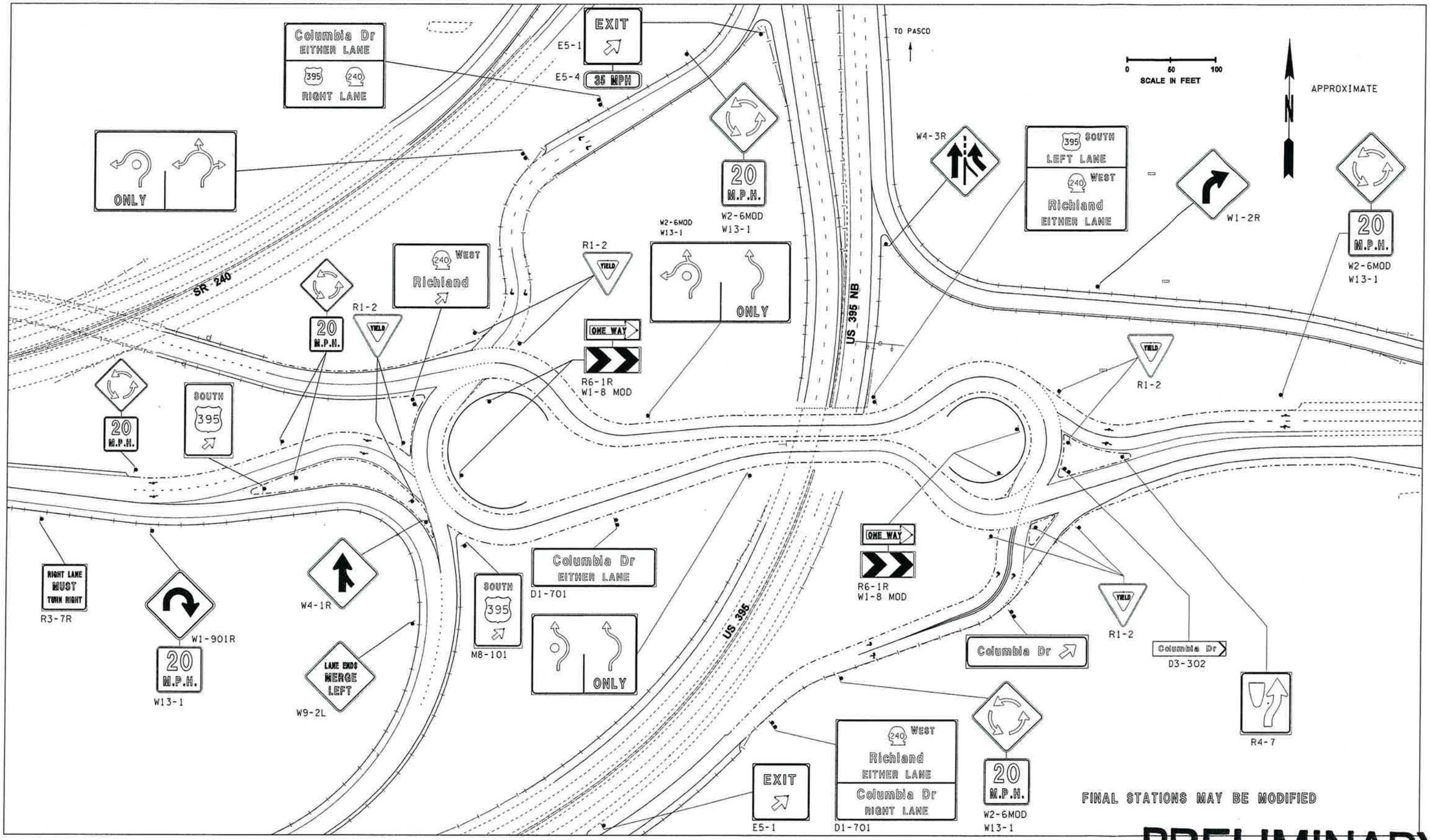
SIGHT

DISTANCE

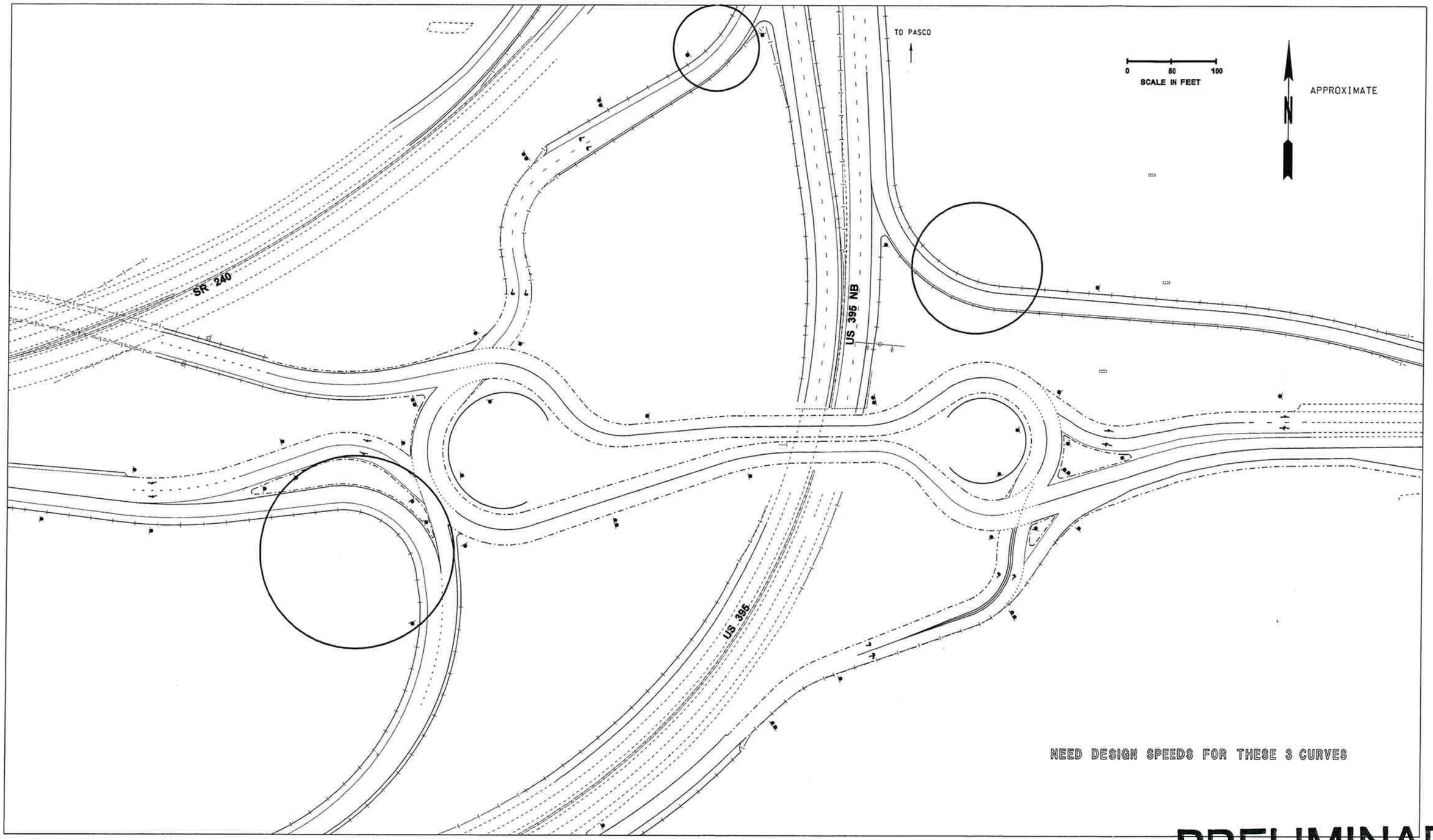
DISPLAY

L2527
Jeremy Jewkes
11-07-2007

PRELIMINARY SIGNING AND ILLUMINATION PLAN



PRELIMINARY

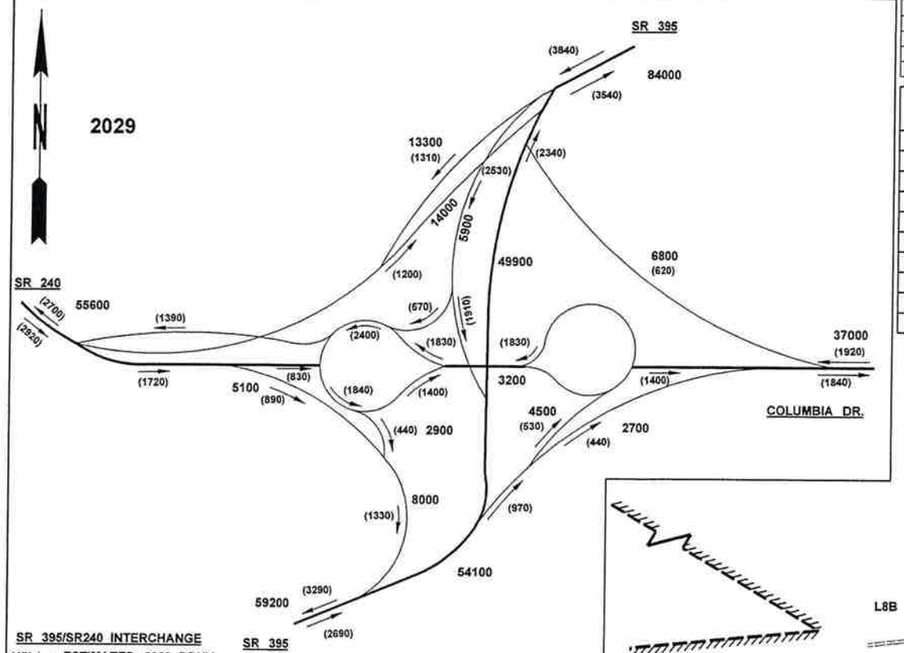


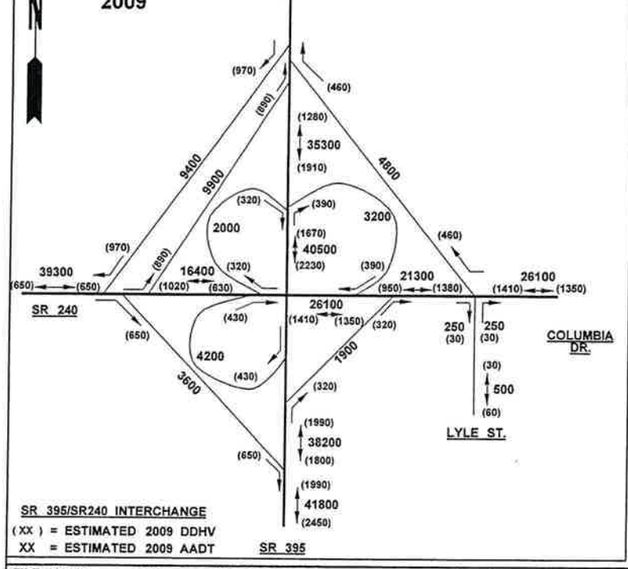
PRELIMINARY

PRELIMINARY

CHANNELIZATION

PLANS





TOTAL CURVE DATA			CURVE DATA			SPIRAL DATA		
P.I. STATION	DELTA	TANGENT	DELTA	RADIUS	LENGTH	S	a	DE	Ls
ER2 12+55.58		255.58'	38°17'34" LEFT	736.15'	491.99'	0.07'/FT			
L8B 17+22.04		418.04'	62°25'10" LEFT	690.00'	751.71'	0.09'/FT			
WR2 14+57.28		380.48'	103°29'22" LEFT	300.00'	541.87'	0.08'/FT			

DESIGN DATA		
	US 395	SR 240
FUNCTIONAL CLASSIFICATION	URBAN PRINICIPAL ARTERIAL	URBAN PRINICIPAL ARTERIAL
DESIGN CLASS	P-1	P-1
DESIGN LEVEL	FULL	FULL
ACCESS CONTROL	FULL	FULL
TERRIAN	ROLLING	ROLLING
POSTED SPEED	45 MPH	60 MPH
DESIGN SPEED	50 MPH	70 MPH
DESIGN VEHICLE	WB67	WB67
PERCENT TRUCKS	5.5%	5.5%

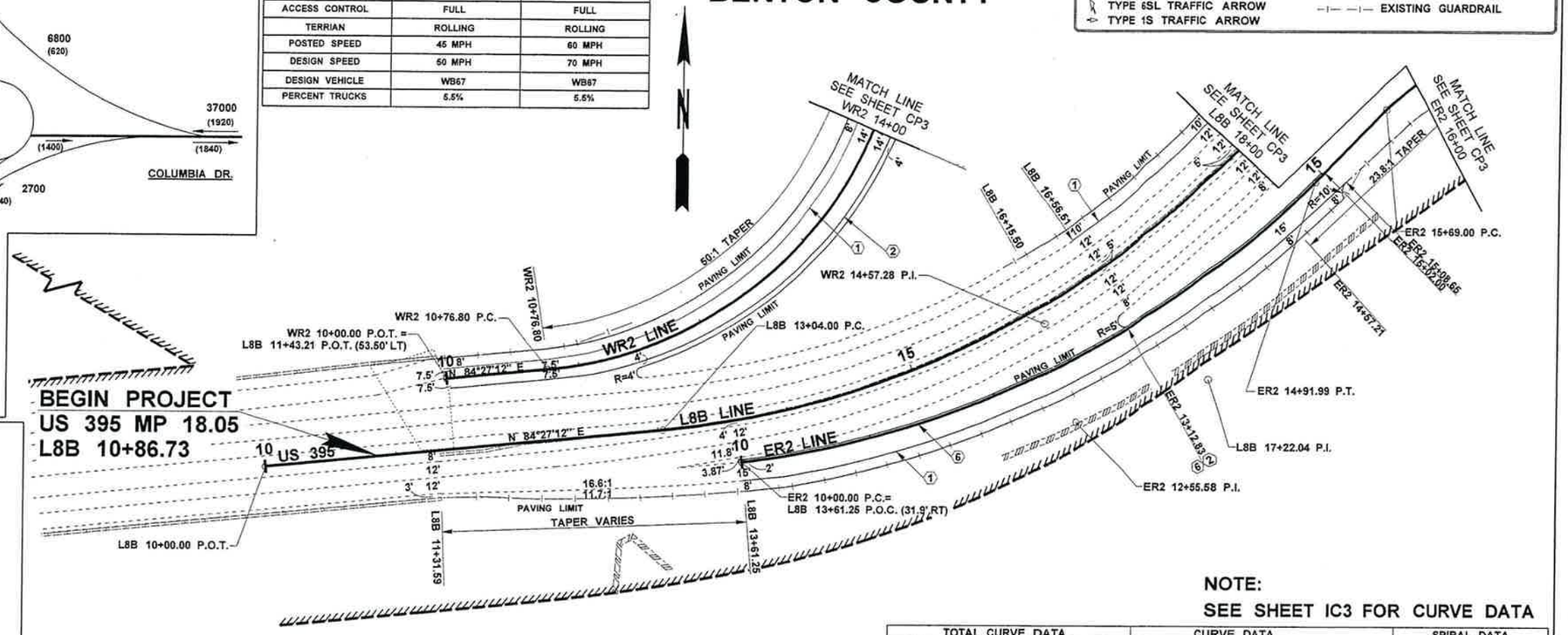
T. 9N. R. 29E. W.M.
BENTON COUNTY

CHANNELIZATION LEGEND

1. EDGE LINE (WHITE)
2. EDGE LINE (YELLOW)
3. LANE LINE
4. DROP LANE LINE
5. DOTTED EXTENSION LINE (WHITE)
6. WIDE LINE
7. DOTTED WIDE LINE

TYPE 2SR TRAFFIC ARROW
TYPE 2SL TRAFFIC ARROW
TYPE 3SL TRAFFIC ARROW
TYPE 6SR TRAFFIC ARROW
TYPE 6SL TRAFFIC ARROW
TYPE 1S TRAFFIC ARROW

ROUNDABOUT LEGEND
BRIDGE
EXISTING BRIDGE
RETAINING WALL
EXISTING RETAINING WALL
BARRIER
EXISTING BARRIER
R/W LIMITED ACCESS
FACE OF CURB AND GUTTER
FACE OF CURB
GUARDRAIL
EXISTING GUARDRAIL



NOTE:
SEE SHEET IC3 FOR CURVE DATA

TOTAL CURVE DATA			CURVE DATA				SPIRAL DATA		
P.I. STATION	DELTA	TANGENT	DELTA	RADIUS	LENGTH	S	a	DE	Ls
B 399+22.29		68.54'	18°36'41" LEFT	500.00'	136.24'	0.02'/FT			
B 401+57.42		113.88'	92°30'26" RIGHT	109.00'	175.99'	0.02'/FT			
ER 50+87.88		30.38'	39°20'12" RIGHT	85.00'	58.36'	0.02'/FT			
ER 52+20.15		45.45'	80°41'45" LEFT	53.50'	75.35'	0.02'/FT			
ER 55+34.70		34.91'	33°46'22" RIGHT	115.00'	67.79'	0.02'/FT			
ER 62+52.71		1002.66'	171°57'21" LEFT	70.50'	211.58'	0.02'/FT			
ER1 12+31.56		71.13'	16°35'06" RIGHT	488.00'	141.30'	0.02'/FT			
ER2 16+04.66		35.66'	23°41'32" RIGHT	170.00'	70.30'	0.02'/FT			
ER2 18+48.09		33.20'	67°09'58" LEFT	50.00'	58.61'	0.02'/FT			
ER2 18+89.47		15.97'	8°29'37" RIGHT	215.00'	31.87'	0.02'/FT			
ER3 10+51.82		43.23'	44°45'24" LEFT	105.00'	82.02'	0.02'/FT			
ER3 11+56.91		47.71'	13°36'16" RIGHT	400.00'	94.98'	0.02'/FT			
L 399+82.81		971.34'	74°42'32" LEFT	1272.55'	1659.30'	0.09'/FT			
LK2 13+35.04		90.79'	10°22'30" LEFT	1000.00'	181.08'	0.07'/FT			
LK2 17+98.40		141.69'	83°03'12" RIGHT	160.00'	231.93'	0.02'/FT			
LR 10+55.03		55.03'	4°52'20" LEFT	1293.55'	110.00'	0.09'/FT			
L8B 21+25.70		69.99'	11°09'44" LEFT	716.25'	139.54'	0.05'/FT			
L8B2 22+97.48		102.23'	12°57'41" LEFT	900.00'	203.60'	0.05'/FT			
L8R2 11+21.72		121.72'	19°43'43" LEFT	700.00'	241.03'	0.05'/FT			
WR 31+10.39		12.66'	4°49'51" LEFT	300.00'	25.30'	0.02'/FT			
WR 32+64.45		45.36'	53°29'40" RIGHT	90.00'	84.03'	0.02'/FT			
WR 34+24.32		90.92'	104°01'28" LEFT	71.00'	128.91'	0.02'/FT			
WR 37+21.22		258.91'	142°27'21" LEFT	88.00'	218.80'	0.02'/FT			
WR 39+40.97		48.91'	17°49'02" RIGHT	312.00'	97.02'	0.02'/FT			
WR1 399+22.41		58.66'	25°46'49" LEFT	300.00'	134.97'	0.02'/FT			
WR1 401+29.27		45.54'	61°11'52" RIGHT	77.00'	82.24'	0.02'/FT			
WR3 10+46.42		36.14'	51°27'03" LEFT	75.00'	67.35'	0.02'/FT			
WR3 11+74.03		69.26'	69°24'35" RIGHT	100.00'	121.14'	0.02'/FT			
WR4 12+02.69		79.93'	29°50'10" LEFT	300.00'	156.22'	0.02'/FT			

APPROVED DEVIATIONS

1. DEVIATION #1: BRIDGE VERTICAL CLEARANCE FOR BRIDGE NO. 395/16
2. DEVIATION #2: ON-RAMP ON LEFT SIDE OF THROUGH TRAFFIC
3. DEVIATION #3: RAMP CONNECTION SPACING
4. DEVIATION #4: VERTICAL CURVE LENGTH
5. DEVIATION #5: DECELERATION LENGTHS
6. DEVIATION #6: SUPERELEVATION OF HORIZONTAL CURVES

EVALUATION UPGRADES

1. EU #1: VERTICAL CURVE LENGTHS

PRELIMINARY

APPROVED BY:

☐ ASSISTANT REGIONAL ADMINISTRATOR FOR DEVELOPMENT

DATE _____ SIGNATURE _____

0 50 100
SCALE IN FEET

FILE NAME	K:\Projects\XL2527\CADD\PlansforApproval\L2527_PS_CP.dgn				REGION NO.	STATE	FED.AID PROJ.NO.	Plot 1
TIME	8:09:19 AM				10	WASH		CP1
DATE	2/21/2008				JOB NUMBER			
PLOTTED BY	ganskem							
DESIGNED BY	K. SABONG/ J. JEWKES				CONTRACT NO.		LOCATION NO.	SHEET
ENTERED BY	M. GANKSE						XL2527	OF
CHECKED BY	K. DANIEL							SHEETS
PROJ. ENGR.	M. DAVARI							
REGIONAL ADM.	D. WHITEHOUSE	REVISION	DATE	BY				

MORTEZA DAVARI — STATE OF WASHINGTON — 21081 — REGISTERED PROFESSIONAL ENGINEER
EXPIRES 04/12/2008 DATE
P.E. STAMP BOX

DATE
P.E. STAMP BOX

Washington State Department of Transportation

US 395 MP 18.05 - MP 18.59
COLUMBIA DRIVE TO SR 240
REBUILD INTERCHANGE

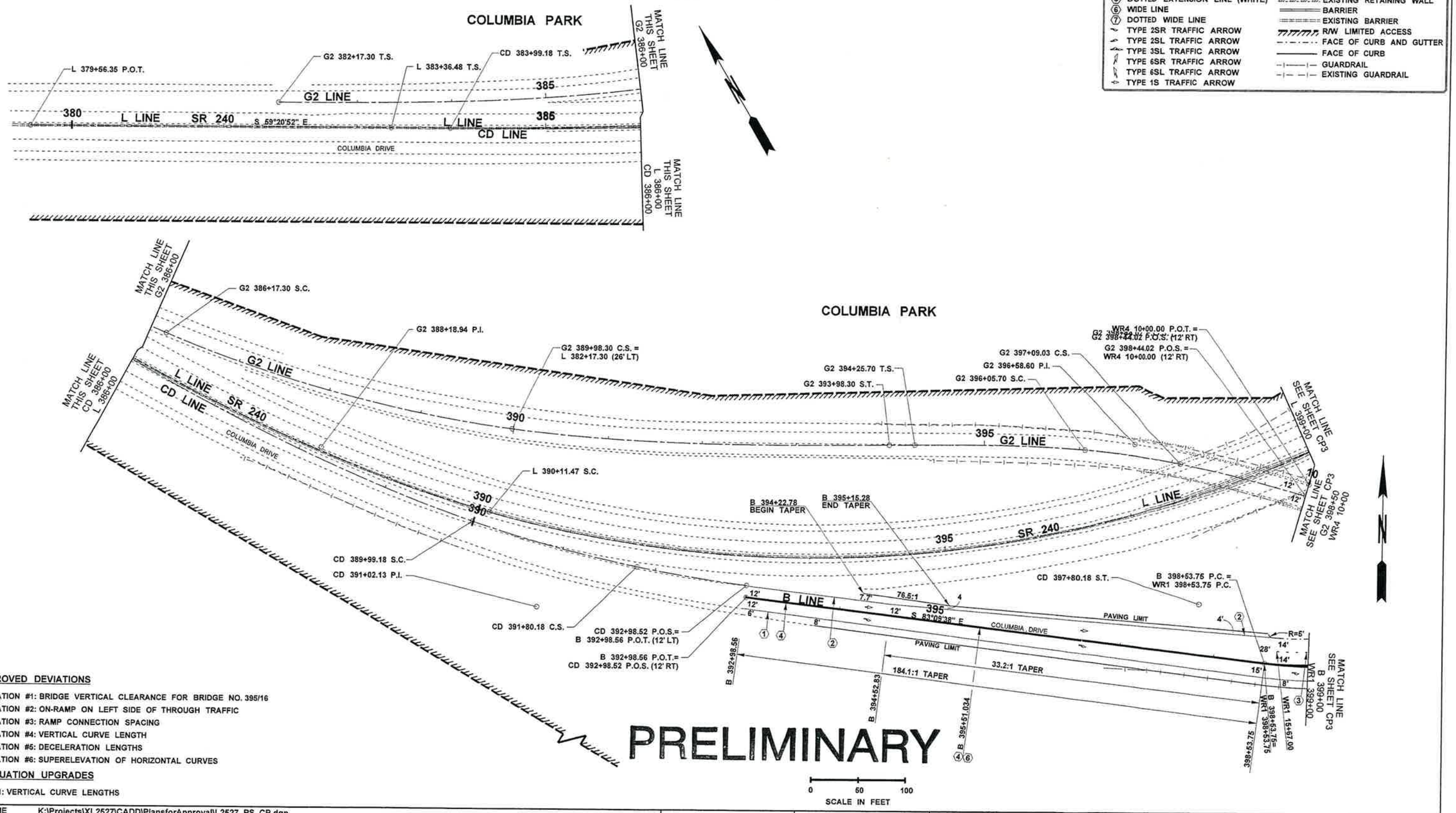
CHANNELIZATION PLAN

TOTAL CURVE DATA			CURVE DATA				SPIRAL DATA		
P.I. STATION	DELTA	TANGENT	DELTA	RADIUS	LENGTH	S	a	DE	Ls
CD 391+02.13	31°14'30.00" LEFT	702.95'	7°14'30" LEFT	1432.50'	181.00'	0.07'/FT	2/3	12°00'	6.00
G2 388+18.94	31°14'30.00" LEFT	601.64'	15°14'30" LEFT	1432.50'	381.00'	0.07'/FT	1	8°00'	4.00
G2 396+58.60	17°00'00.00" RIGHT	232.90'	6°12'00" RIGHT	955.00'	103.33'	0.03'/FT	3 1/3	5°24'	1.80

T. 9N. R. 29E. W.M.
BENTON COUNTY

CHANNELIZATION LEGEND

① EDGE LINE (WHITE)	ROUNDABOUT LEGEND
② EDGE LINE (YELLOW)	BRIDGE
③ LANE LINE	EXISTING BRIDGE
④ DROP LANE LINE	RETAINING WALL
⑤ DOTTED EXTENSION LINE (WHITE)	EXISTING RETAINING WALL
⑥ WIDE LINE	BARRIER
⑦ DOTTED WIDE LINE	EXISTING BARRIER
TYPE 2SR TRAFFIC ARROW	R/W LIMITED ACCESS
TYPE 2SL TRAFFIC ARROW	FACE OF CURB AND GUTTER
TYPE 3SL TRAFFIC ARROW	FACE OF CURB
TYPE 6SR TRAFFIC ARROW	GUARDRAIL
TYPE 6SL TRAFFIC ARROW	EXISTING GUARDRAIL
TYPE 1S TRAFFIC ARROW	



APPROVED DEVIATIONS

① DEVIATION #1: BRIDGE VERTICAL CLEARANCE FOR BRIDGE NO. 395/16
② DEVIATION #2: ON-RAMP ON LEFT SIDE OF THROUGH TRAFFIC
③ DEVIATION #3: RAMP CONNECTION SPACING
④ DEVIATION #4: VERTICAL CURVE LENGTH
⑤ DEVIATION #5: DECELERATION LENGTHS
⑥ DEVIATION #6: SUPERELEVATION OF HORIZONTAL CURVES

EVALUATION UPGRADES

[1] EU #1: VERTICAL CURVE LENGTHS

PRELIMINARY

0 50 100
SCALE IN FEET

FILE NAME	K:\Projects\XL2527\CADD\PlansforApproval\L2527_PS_CP.dgn				REGION NO. 10	STATE WASH	FED.AID PROJ.NO.	Plot 2
TIME	8:09:24 AM				JOB NUMBER			CP2
DATE	2/21/2008							SHEET
PLOTTED BY	ganskem				CONTRACT NO.	LOCATION NO. XL2527		OF
DESIGNED BY	K. SABONG/ J. JEWKES							SHEETS
ENTERED BY	M. GANKSE							
CHECKED BY	K. DANIEL							
PROJ. ENGR.	M. DAVARI							
REGIONAL ADM.	D. WHITEHOUSE	REVISION	DATE	BY				

MORTEZA DAVARI STATE OF WASHINGTON 37061 REGISTERED PROFESSIONAL ENGINEER
EXPIRES 04/12/2008 DATE
P.E. STAMP BOX

DATE
P.E. STAMP BOX

Washington State Department of Transportation

US 395 MP 18.05 - MP 18.59
COLUMBIA DRIVE TO SR 240
REBUILD INTERCHANGE

CHANNELIZATION PLAN

NOTE:

SEE SHEET CP1 FOR CURVE DATA BOX

APPROVED DEVIATIONS

1. DEVIATION #1: BRIDGE VERTICAL CLEARANCE FOR BRIDGE NO. 395/16
2. DEVIATION #2: ON-RAMP ON LEFT SIDE OF THROUGH TRAFFIC
3. DEVIATION #3: RAMP CONNECTION SPACING
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5. DEVIATION #5: DECELERATION LENGTHS
6. DEVIATION #6: SUPERELEVATION OF HORIZONTAL CURVES

EVALUATION UPGRADES

[1] EU #1: VERTICAL CURVE LENGTHS

T. 9N. R. 29E. W.M.
BENTON COUNTY

COLUMBIA PARK

APOLLO SHEET METAL, INC.

PRELIMINARY

SCALE IN FEET: 0, 50, 100

CHANNELIZATION LEGEND

1 EDGE LINE (WHITE)	ROUNDABOUT LEGEND
2 EDGE LINE (YELLOW)	BRIDGE
3 LANE LINE	EXISTING BRIDGE
4 DROP LANE LINE	RETAINING WALL
5 DOTTED EXTENSION LINE (WHITE)	EXISTING RETAINING WALL
6 WIDE LINE	BARRIER
7 DOTTED WIDE LINE	EXISTING BARRIER
TYPE 2SR TRAFFIC ARROW	R/W LIMITED ACCESS
TYPE 2SL TRAFFIC ARROW	FACE OF CURB AND GUTTER
TYPE 3SL TRAFFIC ARROW	FACE OF CURB
TYPE 6SR TRAFFIC ARROW	GUARDRAIL
TYPE 6SL TRAFFIC ARROW	EXISTING GUARDRAIL
TYPE 1S TRAFFIC ARROW	

FILE NAME	K:\Projects\XL2527\CADD\PlansforApproval\L2527_PS_CP.dgn
TIME	8:09:27 AM
DATE	2/21/2008
PLOTTED BY	ganskem
DESIGNED BY	K. SABONG/ J. JEWKES
ENTERED BY	M. GANKSE
CHECKED BY	K. DANIEL
PROJ. ENGR.	M. DAVARI
REGIONAL ADM.	D. WHITEHOUSE

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER

CONTRACT NO. | LOCATION NO. XL2527

MORTEZA DAVARI — STATE OF WASHINGTON — 21081 — REGISTERED PROFESSIONAL ENGINEER

EXPIRES 04/12/2008 DATE

P.E. STAMP BOX

DATE

P.E. STAMP BOX

Washington State Department of Transportation

US 395 MP 18.05 - MP 18.59
COLUMBIA DRIVE TO SR 240
REBUILD INTERCHANGE

CHANNELIZATION PLAN

Plot 3 | CP3 | SHEET OF SHEETS

TOTAL CURVE DATA			CURVE DATA				SPIRAL DATA		
P.I. STATION	DELTA	TANGENT	DELTA	RADIUS	LENGTH	S	a	DE	Ls
LL 12+58.12		258.12'	38°20'19" LEFT	742.50'	496.84'	0.08'/FT			
LL 18+33.42		119.34	15°24'11" RIGHT	882.50'	237.45'	0.08'/FT			
LR 15+30.73		175.46'	35°05'19" LEFT	555.00'	339.89'	0.02'/FT			
L8B2 31+96.53		269.03'	17°47'03" RIGHT	1748.00'	542.66'	0.03'/FT			
L8R2 19+75.53		181.22'	33°20'58" RIGHT	605.00'	352.15'	0.08'/FT			
L8R2 25+31.67		117.37'	8°56'54" LEFT	1500.00'	234.27'	0.05'/FT			
WR3 15+14.93 P.I.		117.19'	67°37'06" LEFT	175.00'	206.53'	0.02'/FT			

CHANNELIZATION LEGEND

1. EDGE LINE (WHITE)
2. EDGE LINE (YELLOW)
3. LANE LINE
4. DROP LANE LINE
5. DOTTED EXTENSION LINE (WHITE)
6. WIDE LINE
7. DOTTED WIDE LINE

TYPE 2SR TRAFFIC ARROW
TYPE 2SL TRAFFIC ARROW
TYPE 3SL TRAFFIC ARROW
TYPE 6SR TRAFFIC ARROW
TYPE 6SL TRAFFIC ARROW
TYPE 1S TRAFFIC ARROW

ROUNDABOUT LEGEND
BRIDGE
EXISTING BRIDGE
RETAINING WALL
EXISTING RETAINING WALL
BARRIER
EXISTING BARRIER
R/W LIMITED ACCESS
FACE OF CURB AND GUTTER
FACE OF CURB
GUARDRAIL
EXISTING GUARDRAIL

T. 9N. R. 29E. W.M.
BENTON COUNTY

APPROVED DEVIATIONS

1. DEVIATION #1: BRIDGE VERTICAL CLEARANCE FOR BRIDGE NO. 395/16
2. DEVIATION #2: ON-RAMP ON LEFT SIDE OF THROUGH TRAFFIC
3. DEVIATION #3: RAMP CONNECTION SPACING
4. DEVIATION #4: VERTICAL CURVE LENGTH
5. DEVIATION #5: DECELERATION LENGTHS
6. DEVIATION #6: SUPERELEVATION OF HORIZONTAL CURVES

EVALUATION UPGRADES

[1] EU #1: VERTICAL CURVE LENGTHS

COLUMBIA PARK

MATCH LINE SEE SHEET CP3 LL 12+00
MATCH LINE SEE SHEET CP3 LR 11+00
MATCH LINE SEE SHEET CP3 WR3 14+50
MATCH LINE SEE SHEET CP3 L8R2 14+00
MATCH LINE SEE SHEET CP3 L8B 26+00
MATCH LINE SEE SHEET CP3

LR 11+10.00 P.T.
LL 12+58.12 P.I.
LL 14+96.84 P.T.
L8R2 19+75.53 P.I.
LL 17+14.08 P.C.
LL 18+33.42 P.I.
L8R2 20+42.89 BEGIN TAPER
L8R2 20+84.08 END TAPER
L8R2 21+07.85 BEGIN TAPER
LL 19+51.53 P.T.
L8R2 21+46.39 END TAPER
L8R2 21+46.46 P.T.
L8R2 22+42.66 BEGIN TAPER
L8R2 21+46.46 END TAPER
L8R2 21+96.46 END TAPER
LL 20+51.99 P.O.T. = L8R2 22+42.66 P.O.T. (35.50' LT)
L8R2 24+14.30 P.C.
L8R2 25+31.67 P.I.
L8R2 26+48.57 BEGIN TAPER
L8R2 26+48.57 P.T.
L8R2 27+06.13 END TAPER
L8R2 27+32.13 P.O.T. = L8B2 38+92.00 P.O.T. (18' LT)
L8B2 38+92.00 P.O.T.= L8R2 27+32.13 P.O.T. (18' RT)
L8B2 37+37.61 END TAPER
L8B 37+62.31
L8B 38+38.16
19:1 TAPER

LR LINE N 40°01'55" E
LL LINE
L8R2 LINE
WR3 LINE
L8B2 LINE N 2°05'24" W
L8B2 LINE N 15°41'38" E
CD LINE
LK2 LINE N 75°35'51.30" W
CD LINE 415
S 88°22'40.00" E
COLUMBIA DRIVE
N 12°33'28" E
N 8°50'58" W
N 27°57'35" E
N 24°30'01" E
N 16°33'06" E

LR 13+00.00
LR 13+55.27 P.C.
L8R2 18+44.32 BEGIN TAPER
L8R2 17+94.32 BEGIN TAPER
L8R2 18+34.52 BEGIN TAPER
L8R2 16+09.82
WR3 14+93.53 END TAPER
WR3 15+41.73
WR3 16+04.23
L8R2 15+43.84
26:1 TAPER 25.4:1 TAPER
18.4:1 TAPER
L8R2 17+94.31 P.C.
L8R2 16+88.33= LR 14+22.48
WR3 16+04.27 P.T. = L8R2 15+43.40 P.O.T. (19.50' LT)
WR3 15+14.93 P.I.
L8R2 14+27.19 END TAPER
L8B 28+07.72
LR 15+30.73 P.I.
L8B2 29+23.05 P.C.
L8B2 31+37.64
L8B2 32+12.64
L8B2 31+96.53 P.I.
L8B2 32+87.64
LR 16+95.16 P.T. = L8B2 31+37.64 P.O.C.
L8B2 34+37.61 BEGIN TAPER
L8B2 34+65.62 P.T.
L8B2 35+45.35
L8B2 37+37.61 END TAPER
L8B2 28+73.05
L8B2 29+23.05
L8B2 30+07.86
L8B2 30+08.08
L8B2 31+37.64
L8B2 33+08.08
L8B2 34+65.62
L8B2 34+90.62
L8B2 24+82.17
L8R2 27+12.27
TAPER VARIES
25:1 TAPER
50:1
20:1
PAVING LIMIT
138.04' PROPOSED BRIDGE NO. 395/385
LR LINE
US 395 SB
US 395 NB
SR 240
COLUMBIA RIVER

APOLLO SHEET METAL, INC.

END PROJECT
US 395 MP 18.59
L8B 38+92.00

0 50 100
SCALE IN FEET

PRELIMINARY

FILE NAME	K:\Projects\XL2527\CADD\PlansforApproval\L2527_PS_CP.dgn				REGION NO.	STATE	FED.AID PROJ.NO.		Plot 4
TIME	8:09:34 AM				10	WASH			CP4
DATE	2/21/2008				JOB NUMBER				
PLOTTED BY	ganskem								SHEET
DESIGNED BY	K. SABONG/ J. JEWKES				CONTRACT NO.	LOCATION NO.			OF
ENTERED BY	M. GANKSE					XL2527			SHEETS
CHECKED BY	K. DANIEL								
PROJ. ENGR.	M. DAVARI								
REGIONAL ADM.	D. WHITEHOUSE	REVISION	DATE	BY					

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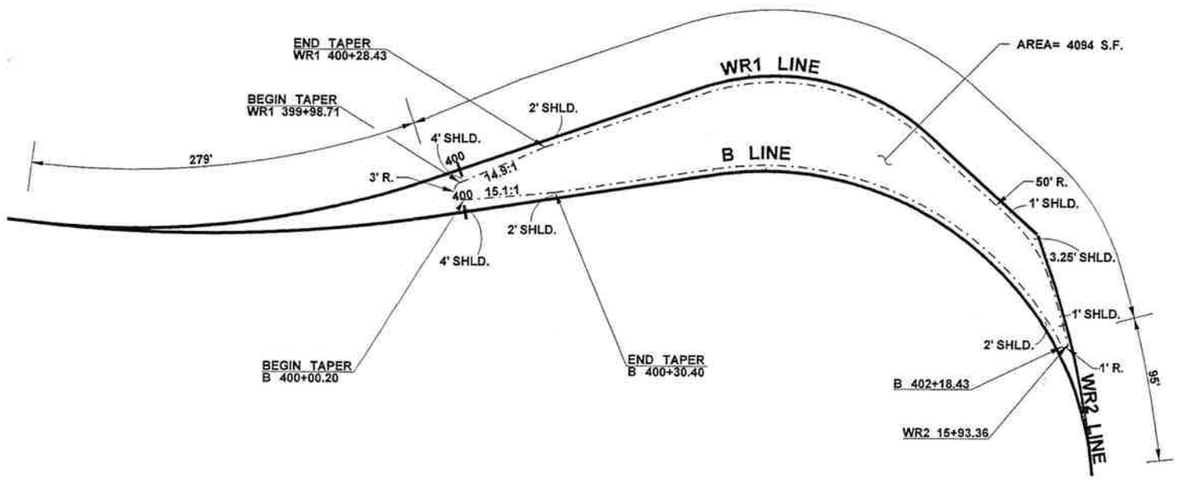
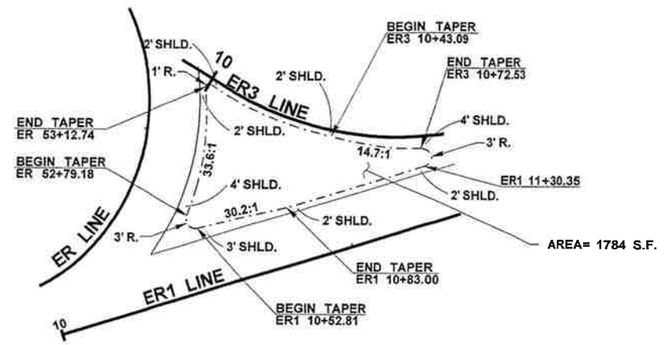
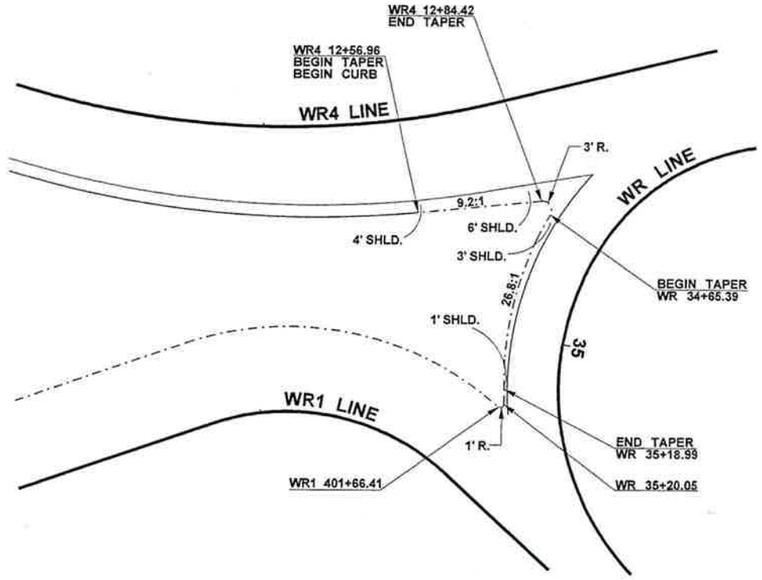
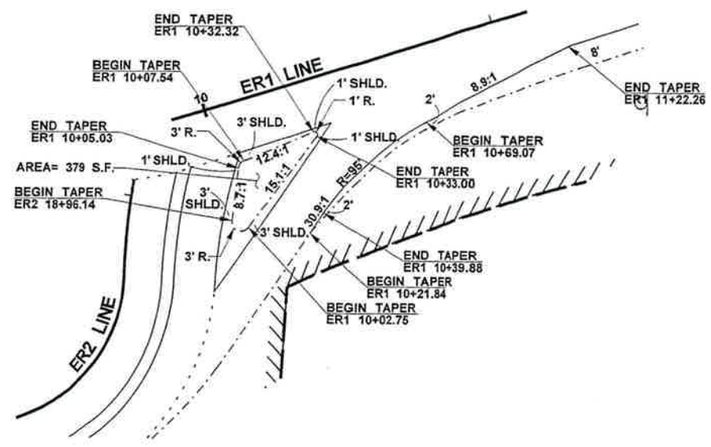
REBUILD INTERCHANGE

CHANNELIZATION PLAN









PRELIMINARY

NOT TO SCALE

FACE OF CURB AND GUTTER

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TIME	8:09:38 AM				10	WASH	
DATE	2/21/2008				JOB NUMBER		
PLOTTED BY	ganskem						
DESIGNED BY	K. SABONG/ J. JEWKES				CONTRACT NO.	LOCATION NO.	
ENTERED BY	M. GANKSE					XL2527	
CHECKED BY	K. DANIEL						
PROJ. ENGR.	M. DAVARI						
REGIONAL ADM.	D. WHITEHOUSE	REVISION	DATE	BY			

P.E. STAMP BOX — DATE

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US 395 MP 18.05 - MP 18.59
COLUMBIA DRIVE TO SR 240
REBUILD INTERCHANGE

CHANNELIZATION PLAN

Plot 5

CP5

SHEET OF SHEETS